SCIENTIFIC AMERICAN

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Patents and Trade Marks in England.

The Commissioners of Patents for Inventions for Great Britain have just issued their report for the year 1877. They state that the number of applications for patents during the year was 4,949, or 120 less than in the preceding year, when the number was 5,069, to which amount they had increased from 1,211 in 1852—the year in which the Patent Law Amendment Act came into operation. The published tables show that only about 29 per cent of the patents from 1852 to 1870 paid the third year's stamp duty of £50, and continued in force to the end of the seventh year, and that only 10 per cent paid the seventh year's stamp duty of £100, and consequently remained in force for the full term of fourteen years.

The Patent Office Museum, containing models, machines, and instruments, principally illustrative of patented inventions, is at present at South Kensington, and is open to the public daily, free of charge. Any patentee who may be desirous of exhibiting a model of his invention in London may place it in this Museum, where models are received either as gifts or loans. While the number of applications for the registration of trade marks during the year 1877 has been considerably less than during the first year of the establishment of the Trade Marks Registry, the Commissioners state that, so extensive is the use of these marks in the cotton trade, special provision had to be made for dealing with them at Manchester, where, since the date of the last report, a committee of experts have been engaged in the examination of 41,712 marks for cotton piece goods.

If more of our manufacturers in the United States would avail themselves of the protection offered by having trade marks registered on their products, both in this country and abroad, we believe they would derive a profitable return for a very small investment.

THE MANUFACTURE OF THE CHICKERING PIANO.

In no department of American manufacture has the progress of the past half century been more marked than in the manufacture of pianos; and no establishment has had a greater or more commendable influence on the progress of that art than that of the celebrated house of CHICKERING & SONS.

This house, now the oldest and we believe the largest in the pianoforte business in America, was established in Boston in the year 1823. At that time the manufacture of pianos was but feebly carried on; the instrument itself was a poor affair compared with the modern piano, and all classes regarded it as a luxury for the few, rather than the household necessity for all well-to-do people which it has now become. To the inventive genius of Mr. Jonas Chickering, the founder of the house, and his thoroughgoing integrity and energy as a manufacturer, the present excellence of the American piano as well as the flourishing condition of the pianoforte business of this country is largely due. The most important and most conspicuous of the real improvements in all classes of pianos are those by which the compass of the instrument has been increased and the scale enlarged, thereby giving greater range and volume, and finer quality of tone. These improvements have been largely achieved by the labors and inventions of Messrs. Chickering & Sons.

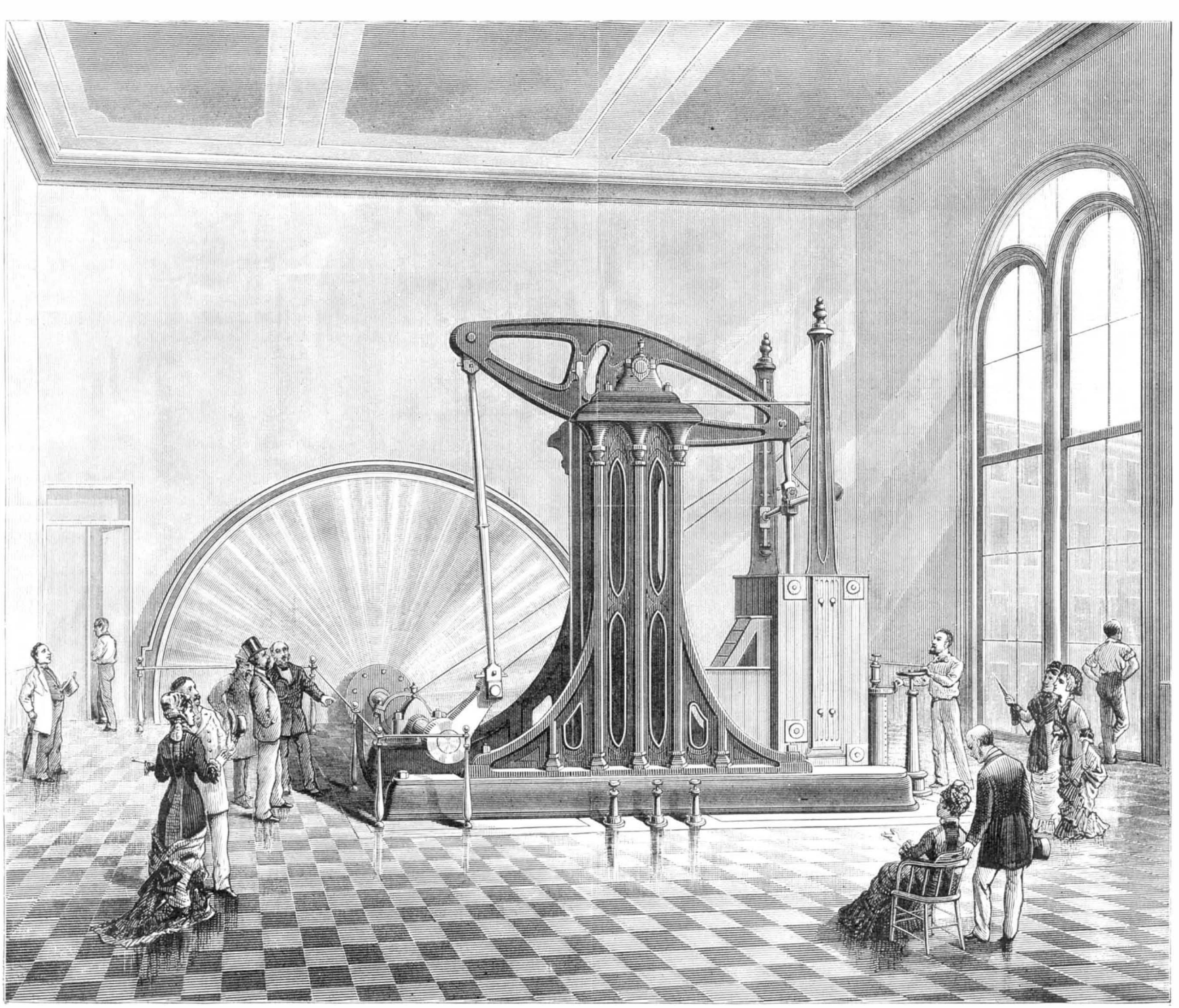
In selecting the factory of Messrs. Chickering & Sons to furnish typical illustrations of the leading operations incident to pianoforte making, our artist has chosen one that may fairly stand in the front rank with the best mechanical as well as musical establishments of the country.

In the manufacture of a superior pianoforte the selection and preparation of the wood is a matter of prime importance.

The various kinds of wood made use of must be selected with the most discriminating care, and even then but limited portions of such woods will answer for this exacting manufacture. After undergoing the necessary term of outdoor seasoning, the selected lumber is taken to the drying rooms, where it remains until thoroughly seasoned. From the drying rooms the seasoned wood, now technically known as stock, is taken to the sawmill, and cut up into dimensions suitable for the three different styles of pianos, namely, grand, upright, and square.

In Fig. 6 (page 260) our artist has depicted the process of sawing veneers. From the mill room the prepared stock goes to a well ventilated apartment, the stock room, which is kept at a uniform temperature of eighty degrees Fahren-

[*Continued on page* 258.]



THE CHICKERING PIANOFORTE MANUFACTORY.—VIEW OF THE ENGINE ROOM.—Fig. 1.

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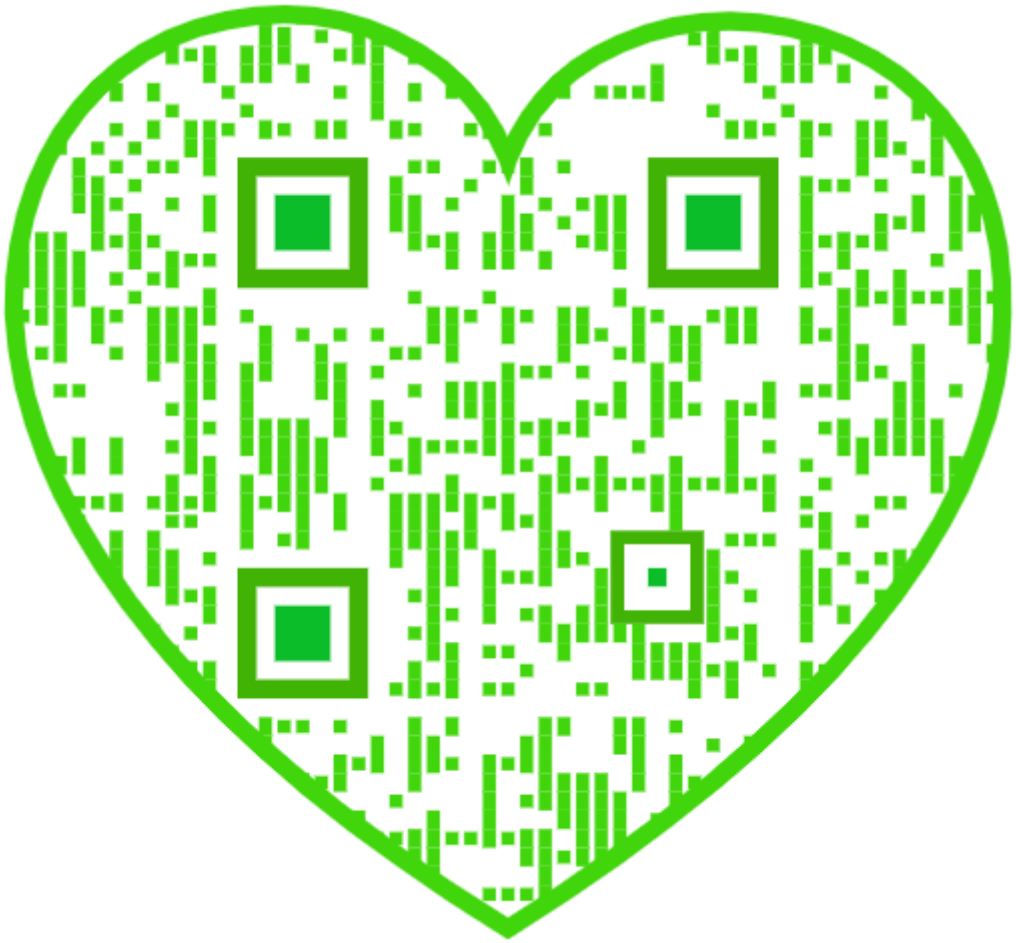

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VOL. XXXIX., No. 17. [NEW SERIES.] *Thirty-third Year.*

NEW YORK, SATURDAY, OCTOBER 26, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

Alizarin carmine..... 257
Arsenic..... 262
Arsenic in sulphuric acid pyrites 257
Astronomical observation..... 259
Barrel machinery, court decisions 256
Beehive, new*..... 263
Cables, telegraph, submarine..... 263
Carpets, Smyrna and Persian..... 264
Champagne cider recipe [2]..... 267
Cook, Captain*..... 264
Cotton worm, a cure for..... 266
Crucibles, mixing [6]..... 267
Elasticity, modulus of 257
Electro-plate, Amer. in England. 265
Emigration from Canada..... 257
Exhibits, agricultural, Am., Paris 257
Fowler, Mr., crossing channel*... 268
Fruit, preservation of..... 263
Gas, hydrogen..... 266
Gaslight..... 260
Gaslight, influence of on the eye 263
Gas wells in Ohio, remarkable... 257
Gold, intrinsic value of [4]..... 267
Gold, 18-karat, compound for [5]. 267
Ink, marking 259
Ink, white [27]..... 267
Inventions, new..... 261
Inventions, new agricultural..... 266
Inventions, new mechanical. ... 262
Jute, American..... 266
Labor and trade in Italy..... 265
Labor in Massachusetts 265
Lead salts and ammonia 259
Locomotives, Am. for Australia. 265
Magnets, to harden [33]..... 268
Milk test, a..... 262
Mines, pneumatic appliances for 260
Mining laws, history of 263
Mustard congress, a..... 263
Natural history notes 266
Patents in England..... 255
Piano, Chickering, manuf. of*... 255
Pipes, water, best [1] 267
Prehistoric instrument, modern. 257
Progress, proofs of..... 265
Protractor, new*..... 262
Rapid transit, noise of..... 257
Reaping machines 265
Regulator, true-time*..... 262
Rivers, S. A., surveys of..... 260
Rubber gum, to melt [3]..... 567
Science, American..... 259
Sea beacons, lighting..... 257
Sewing machine motor, want of. 262
Sheep shears, new guard for*.... 265
Smoke, plan to banish..... 256
Stars, temporary and variable... 264
Stopper, measuring, new*..... 265
Stove, the Alhambra*..... 261
Tea and coffee, compressed..... 260
Telephone, "call" for [20] 267
Tissues, transplantation of..... 260
Tools for young people 258
Vinegar from wine and cider [19] 267
Water, absorption and excretion 260
Water, flow of, through pipes... 256
Wax, modeling [25]..... 267

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 147,

For the Week ending October 26, 1878.

Price 10 cents. For sale by all newsdealers.

I. ENGINEERING AND MECHANICS.—Lighthouse Illumination. By J. R. WIGHAM. A paper read before the mechanical section of the British Association. Description of Galley Head Lighthouse, Ireland. The use of gas for lighthouses, with an improvement. The combined gas and electric light for lighthouses. A mode of lighting sea beacons from the shore, 4 figures.
A New England Silver Mine.

II. ARCHITECTURE AND BUILDING.—Cottages. Practical hints on accommodation and arrangement; points to be guarded against; foundations; drains; light; and ventilation.—Window Sashes and Panes. The styles in use, with their merits and demerits, 3 figures.

III. FRENCH UNIVERSAL EXPOSITION OF 1878.—Captain Boyton at Paris. Description of his swimming apparatus, with the interesting trial at Paris, and 2 illustrations.—Terra Cotta Vases, with 1 illustration.—French Hatters.—Soiree of the French Association for the Advancement of Science. 1 illustration.—Façade of the Swiss Section, with 1 illustration.—Baville's Tool Holders, for Lathes, Planing Machines, Shaping Machines, Slotting Machines, etc., with 24 figures.—Oscillating Stone Crusher, 1 figure.—Cement Testing Machine, 1 figure.

IV. TECHNOLOGY.—The Carbonization of Wool and Woolen Cloth. Frezon's and Lix's methods. Joly's process. Carbonization by gas.—Beer.—Waste Waters from Wool Scouring, Fulling, etc. By ED. NEUMANN.—Economical Evaporation, 1 figure of apparatus.—New Dye. Alizarine Carmine.—Bleaching of Textiles.

V. CHEMISTRY AND METALLURGY.—Estimation of Manganese, Lead, Copper, Zinc, and Nickel, and their Alloys. By A. RICHE.—A New Test for Glycerin. Glycerin in beer, in water, in wine, in milk, in treacle.—Preparation of Metallic Chlorides.—Action of Chlorine.—Metallic Arsenides. Silver, gold, copper, lead, nickel, cadmium, iron, and zinc arsenides.—Heat by Chemical Action.—Atmospheric Ozone.—Atmospheric Hydrogen Peroxide.
Action of Iodine upon the Oxides and Carbonates of the Alkaline Earth Metals.—Formation of Quartz.—Alloys of Aluminum and Gallium.—Meteoric Brecchia, St. Catherine, Brazil.—Formation of Hydrocarbons by the Action of Water.—Guaiacum as a Test for Copper.—Piney Tallow.—Manufacture of Plaster.—Petroleum Soaps.—Coal Dust.

VI. ELECTRICITY, LIGHT, HEAT, ETC.—Temperature of Flame. By F. ROSETTI. Luminous and non-luminous gas flames. Flame of Stearin Candle. Flame of a Lactelli Lamp. Flame of a Petroleum Lamp. Alcohol flame. Mixture of gas and air. Mixture of gas and nitrogen. Mixture of gas and carbonic anhydride.—The Electro-magnet a Receiving Telephone.—The Province of Mathematics. From the address of President SPOTTISWOODE before the British Association.—Manifold Space. From President SPOTTISWOODE'S address.—Measurements in Physics. From President SPOTTISWOODE'S address.—Apparatus for Varying the Intensity of Currents.

VII. MEDICINE AND HYGIENE.—The Art of Preserving the Eyesight. From the French of ARTHUR CHEVALIER. No. XI. Conclusion. Advice on the Hygiene of the Eyes, with one figure.—Reunion and Restoration of Divided Nerves.—Gastrotomy in Stricture of Œsophagus. With report of a successful case by Prof. F. Trendelenburg, of Rostock. By W. THOMSON, M.D. 1 figure.—A Simple Test of the Quality of Drinking Water.—Hydrophobia.

VIII. AGRICULTURE, STOCK RAISING, ETC.—The Agricultural Products of Cyprus.—Newfoundland.—Measuring the Height of Trees, with 2 figures.—Herefords, Cotswolds, and Berkshires. Cotswold Buck, with 1 illustration.—Cow Milking Apparatus, with 1 figure.—Pears.

FLOW OF WATER THROUGH PIPES.

Very frequently some one who has a pump, or cistern, or spring, wishes to know how much water will be discharged through a pipe of a stated size under a given head, or how large a pipe is necessary to fill a certain vessel or reservoir in a required time. Most of the calculations to this effect are made by rule of thumb; the rest are generally so buried in formulas that nobody can find out anything about them without first going to college, and then possibly going crazy. It may, then, be interesting to run over the following simple rules for determining the above-mentioned elements.

In the first place, this can never be known exactly, except by actual measurement; because all pipes are not equally smooth inside nor evenly laid to begin with, and some get crusted over with mud or scale. It is always best to allow 5 per cent margin, so as to be sure and have pipes large enough. It must be borne in mind that larger pipes cost less proportionately than smaller ones; as a very trifling increase in diameter counts up very rapidly in the amount of area and discharge.*

We want to make some very simple "sums" with the following elements: head or pressure, length of pipe, and diameter.

Head means vertical distance every time—vertical distance between the level of the water in the reservoir above and the center of gravity of the discharge orifice below. Some think that when pipes discharge under water the head is less than if they discharge into open air; but no one who is posted allows more than $\frac{1}{75}$ difference. Thus if a reservoir 120 feet above the standard level discharge 10 feet above this standard, through a pipe whose discharge orifice is 50 feet below water, the head is 110 feet all the same. Some parts of a pipe may have greater head than others.

Another thing worth noting: it does not make a particle of difference whether the pipe is level, inclined upward, or inclined downward, as far as the quantity of water discharged is concerned, the length and head remaining the same.

It is essential that the upper end of the pipe be sufficiently immerged to let it fill well; and there will be a certain amount of head lost in overcoming friction. The upper part of the head may be said to produce velocity, and the lower part to overcome friction; we may divide the whole into the "velocity head" and the "friction head."

A pipe might be so laid as not to have any bursting pressure upon it, by putting it all upon the "hydraulic grade" line—a line drawn from the true velocity head to center of gravity of the discharge end. In such case it would have on it only the weight of the water, upon its lower side. The bursting pressure on any point is determined by its vertical distance from this inclined grade line. It is curious that if a full flowing pipe be tapped at any point on its upper side, the water will rise to this inclined hydraulic grade line, and not to the level of the reservoir. If the discharge be stopped the jet will rise above the grade line; or if there be an obstruction between the reservoir and the jet the latter will fall.

Wooden pipes have about $1\frac{3}{4}$ the frictional resistance that equally smooth cast iron ones have; corroded iron pipes double that of new smooth ones. Our formulas following are for smooth new cast iron pipes, more than four diameters long. (All dimensions must be in feet.)

We will multiply the head by the diameter. Add the length to 54 diameters, and divide this into the first found product, and take the square root of the quotient. Forty eight times this square root is the velocity in feet per second. If we multiply this by the area we get the discharge in cubic feet per second; and we can turn this into U. S. standard gallons by multiplying by 7·48.

Thus we have a 4 inch pipe 962 feet long, with a discharge 60 feet below the surface of the reservoir. How much water will flow through it?

$60\times\frac{1}{3}=20$; $962+\frac{54}{3}=980$; $\frac{20}{980}=\frac{1}{49}$; $\sqrt{\frac{1}{49}}\times 48=\frac{48}{7}=6{\cdot}857+$. $6{\cdot}857\times{\cdot}0873={\cdot}5916$ cubic foot per second. ${\cdot}5916\times 60=35{\cdot}496$ cubic feet per minute. $35{\cdot}496\times 7{\cdot}48=265{\cdot}492+$ gallons per minute.

There is another rule which we will try, to see how nearly the results agree: Multiply the fifth power of the diameter by the head, and divide (as before) by the length plus 54 diameters. 37·6 times the square root of this will give the discharge in cubic feet per second.

$$37{\cdot}6\sqrt{\frac{\frac{1}{243}\times 60}{980}}={\cdot}5967 \text{ cubic foot per second} = 35{\cdot}802 \text{ cubic feet per minute} = 267{\cdot}172+ \text{ gallons per minute.}$$

Bends do not materially affect the discharge if they have radii longer than five diameters of the pipe.

To find either the area of pipe, or the mean velocity, or the quantity discharged, when the other two are given, we work out permutations of the formulas used above. Thus the area necessary for a given discharge and velocity = discharge divided by the velocity; the mean velocity equals the discharge divided by the area; the discharge equals the area multiplied by the velocity.

A COCKNEY PLAN TO BANISH SMOKE.

In a long article showing how London fogs are a purely local product, due to the heat, smoke, surface, emanations and sewer gas of that sadly afflicted city, the London *Medical Examiner* seriously proposes to get rid of the evil by collecting the smoke and sending it out to sea. It says:

"We shall perhaps be thought visionary in our views, but we hope the day will come when London smoke will be dealt with like London sewage—collected from each house and sent out to sea. The expense would be doubtless great, and the difficulties considerable, but the benefits would be still greater, smoky chimneys and dangerous and unsightly chimney pots being abolished forever. For every fire the requisite amount of draught might be secured by a simple arrangement and independently of length of flue or height of house. The smoke would necessarily have to be drawn away by steam fans, and discharged at different points on the sea coast, according to the direction of the wind. The laying of the street flues would not involve a quarter of the trouble or expense incurred in the main drainage works, and the alterations necessary in each house would be of less account than the annual taking up the drains, which is necessary in so many of our tenements. The only great difficulty when the pipes were once laid would be in the matter of sweeping, but we should imagine that this would be easily surmounted. The proposal we have made is certainly a bold one, and not likely to be seriously discussed for years to come. But let the mind dwell for a moment on its certain results. Think of the clear and pure atmosphere, of the final abolition of the London fog, of the flowers that would bloom at every window, and the creepers that would flourish on every wall. Think of the health that would be infused into all, whether dwelling in squares or alleys, of the clean faces, of the Paris-like houses, of the untarnished spoons. Why, the whole expense might be saved in a year or two out of washing bills and the cost of repairing the Houses of Parliament. But whether this great reform be ever adopted or not, this thing is certain, that without it there can never be any such thing as an 'Ideal London.'"

All very well, a Yankee would say, if London must be a great smoke factory; but wouldn't it be easier to stop making smoke? The pipes that would carry the smoke away might be put to a better use in bringing into the city the means of securing heat without smoke. The fuel now wasted by imperfect combustion and smoke-making would supply gas enough to heat the entire city, with a blazing fire in every room; and the saving of fuel would soon pay for the pipes.

It will be many years, however, before the conservative Londoner will be willing to give up his coal fire, no matter how offensive and wasteful; so that, if ever got rid of, London smoke will most likely be banished by improvements in household methods of coal burning. To a very large extent the smoke might be done away with by the adoption of existing American stoves and improved grates for fireplaces; yet there is large room for the improvement and adaptation of these for the special work there required of them. Hitherto it has been slow work for an American invention to win recognition in England; but the conditions are rapidly changing. American "notions" are making their way even in London. And we have no doubt that our American inventors could do a good thing for themselves, as well as for London, by turning their attention to the smoke problem there.

DECISION OF THE COURTS RELATING TO BARREL MACHINERY.

A very important decision concerning barrel making machinery has just been handed down by Hon. H. H. Wheeler, United States District Judge, who presided at the United States Circuit Court in the Southern District, several months since.

The case was entitled The American Barrel Machine Company *vs.* Lowell M. Palmer, but the real defendants were the well known barrel machine manufacturers, Messrs. E. & B. Holmes, of Buffalo, N. Y., whose patents were assailed in this action. The complainant is a Massachusetts corporation, and the suit has been pending about four years.

The patents owned by the complainants were originally granted to Wm. Trapp for "improvement in barrel machinery," and to John Tilley for "improvement in machines for chamfering barrels," the former being virtually for finishing the ends of barrels, ready for the heads, by placing the barrel in a revolving cylinder and applying by hand howeling and chamfering tools while the barrel is revolved; the latter patent is for two rotary truss rings for holding barrels during the same operation, in collars movable laterally to receive and release the cask, with peculiar shaped knives operating to cut the croze and chamfer in the barrel. Nearly all of this work is done by the Holmes patent automatically after the revolving cutter heads are adjusted, the knives for doweling and crozing the barrel being run very rapidly.

Judge Wheeler's decision is as follows:

The claims of the patent are in two parts, one for the truss rings, the other for their combination with the knives. Upon the evidence, it also satisfactorily appears that the truss rings were known and used before, and that Tilley was not the first inventor of them. The knives were probably new in form and mode of cutting, but the defendant does not make use of any knives, either of that form or that operate in that mode. The defendant's cutting machines cut in the same direction with reference to the staves, but that does not infringe the patent. Tilley did not, and probably could not, obtain a patent for the mere direction of cutting. The defendant appears to make use of the truss rings, but not of the tools. He would infringe the first claim, but that is not valid. He does not use the combina-

* Thus, an increase of $\frac{1}{16}$ in diameter gives nearly $\frac{1}{4}$ more discharge; $\frac{1}{8}$ more diameter, almost $\frac{1}{2}$ more discharge, etc.

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tion covered by the second claim, and does not infringe that. So the defendant appears to be entitled to a decree in his favor. Let a decree be entered accordingly, dismissing the bill of complaint, with costs.

THE MODULUS OF ELASTICITY.

Up to a certain limit a body lengthens, shortens, or bends equally under equal additions of load; beyond this point this is not true; if it were a rod could be doubled in length or shortened to nothing. This load in pounds, which would, at this rate, stretch to double length or compress to nothing a bar one inch square of any material, is the modulus of elasticity.

It is thus an imaginary load, bearing the same proportion to a load producing any given amount of stretch, as the original length of a uniform bar is to the length of this stretch.

And the use of this assumed weight or load is to render easy certain calculations. Thus, to find the load in pounds required to produce a given stretch within the elastic limits, is equal to the required stretch multiplied by the modulus of elasticity, and by the cross section, and divided by the original length. And to find the stretch produced by any load within the elastic limit, the product of the load by the length must be divided by the modulus times the cross section.

It may be interesting in this connection to enumerate some of the strengths of various materials in pounds per square inch. It should be borne in mind that large metal bars are weaker in proportion to area than small ones; and that cold-rolled iron bars, although not any denser, are from ¼ to ½ stronger.

Cast brass stands about 18,000 lbs., while annealed brass wire is equal to 49,000, and hard or unannealed, 80,000. Copper sheet, 30,000; bolts, 36,000; wire, 60,000. Gun metal (copper and tin), from 22,000 to 39,000. There is a cast iron called gun metal that is good for 38,000. English cast iron, 18,000; American, very much higher, which must be taken in consideration when Englishmen and others call our machine framing light. Wrought iron rolled bars, 40,000 to 75,000; best American, 76,000; Low Moor, 6,000; plates, 50,000; hard wire, 75,000; wire ropes, 38,000; large forgings, 35,000. English steel plates, 65,000 to 103,000; Hussey, of Pittsburg, 95,000; Bessemer, 98,500; Bessemer tool steel, 112,000; wire, 200,000 to 250,000; rolled and hammered Bessemer ingots, 125,000; cherry red tempered, 214,400; chrome steel, 18,000. The strongest steel stretches the least.

THE NOISE OF RAPID TRANSIT.—A CHANCE FOR INVENTORS.

Our distant readers may not be aware that the system of rapid transit on high level roads now existing in New York city now embraces some fifteen miles of elevated roadway, traversing several of the principal streets and avenues of this city. Thirty or forty additional miles of similar works are also now in progress. The system has demonstrated rapid transit to be a great convenience, indeed a real necessity. It has also proved to be a very serious annoyance to such as dwell or conduct business in or near the streets traversed by the roads.

The roads may be described as iron bridges supported by iron columns, running lengthwise of the streets, either at the sides, as in the case of the New York Elevated Road, or over the middle of the street, as in the case of the Metropolitan Road. In the narrow business streets, down town, the structures overshadow the entire street; and even in the wider avenues the supporting columns greatly obstruct the groundways, and quite destroy their former openness and generous breadth.

But this is the least of the objections against elevated roads. Any one who has stood near an iron trestle bridge, over which a railway train was passing, can form some idea of the roar of trains along the elevated ways; and, running as they do at brief intervals, there is scarcely any intermission to the noise. The natural consequence has been a great depreciation in the value of property along the roads. This is particularly apparent along the avenues devoted to retail shops, dwellings, schools, and churches.

In many instances tradesmen have been driven to other and quieter streets; schools and families have had to seek other quarters; while those that remain subject to the noise are all but distracted by the incessant din, and the impossibility of getting restful sleep.

In addition to the noise, the obstruction of traffic on the ground, and of light and air above, the residents along the lines complain bitterly of easily removable nuisances attending the movement of the trains—the ceaseless outpouring of locomotive smoke, charged with stifling gases, the dropping of cinders and oil upon persons beneath, the shrieking of engine whistles, and the harsh noise of escaping steam.

The brunt of the opposition has been directed against the Sixth avenue road, which has at last been presented as a nuisance by the Grand Jury of the Court of General Sessions, who ask that the Attorney General and the Legislature shall take steps to redress an outrage which they, the members of the jury, "are confident would never have been sanctioned had its enormity been realized." This in response to a petition signed by a large number of citizens complaining of serious annoyances and discomforts to which they were subjected by the road, and asking that it might be indicted as a public nuisance.

These complaints have been investigated carefully and patiently, and the testimony of many witnesses has been taken; and the Grand Jury is of opinion that the road complained of is, in many respects, a grievous nuisance. They believe that the erection of such a structure in a thoroughfare like Sixth avenue was a most unfortunate mistake, and is a great calamity. They believe that if the Legislature of the State could have anticipated the results that have followed from their action in chartering the road, such charter would never have been granted.

In addition to the necessary evils attending a road of the sort over a street like Sixth avenue, the jury mention several unnecessary evils which might be and ought to be remedied at once. Among these are the dropping of oil and cinders; the generation of unwholesome and disagreeable gases by the engines; and, to a large extent, the noise of the trains.

The road was not indicted as a nuisance, because the Grand Jury were of the opinion that a criminal proceeding is not the best way to abate the nuisance, unless others fail, and they were confident that the rights of the people would be vindicated by the courts and the Legislature.

That the public at large will be willing to give up the advantages of rapid transit, even by an objectionable system now that it exists, is very doubtful. The real problem therefore is to reduce to the smallest possible quantity the evils inseparable from elevated roads. To a considerable extent the solution of this problem lies directly within the power of the directors of the roads. By using purer coal, and by improving the combustion of it, the greater part of the smoke, cinders, and noxious gases can be prevented and kept from poisoning the air. The noise of escaping steam can be largely abated by the use of existing inventions; and the shrieking of the engine whistle might easily be dispensed with. The dropping of oil, hot cinders, and the rest is the result of sheer carelessness.

The silencing of the running gear and the too resonant structure is not so easy; yet it is safe to say that a very large part of the rumble and clang and din can be abolished. Our inventors have not failed in any task yet presented to them; and surely they will not allow this resounding and intolerably urgent demand to go long unmet. There is money in it, as well as health and comfort to thousands.

We may add that perhaps the oldest of our great inventors now living, the venerable Peter Cooper, has undertaken the task of silencing the nuisance by invention, being driven to it in order that the efficiency of his great benefaction, the Cooper Union Free School of Science and Art, may not be permanently impaired by the noisy monster at its door. Even when the class rooms have been shifted to the opposite side of the building, it is with great difficulty that the work of the school can go on.

The problem is to secure high speed, at high levels, with the least noise. The problem is a complicated one, and many partial solutions are possible. Whoever diminishes the noise in any essential particular will do a good thing and meet with a sure reward.

It is noticeable that every departure from the simple round iron and wood structure of the first built portion of the Ninth avenue road has been attended by a large increase in noise. The substitution of flat iron for round in the supporting columns and braces, and the multiplication of pieces in the trestlework, seem to have multiplied the reverberating surfaces and raised the pitch of the sounds, more rapidly than it increased the strength and stability of the structure. Accordingly, instead of the original low rumble, we have now a multitudinous clang, sharp, discordant and irritating. Should it prove impossible to do away with any considerable portion of these loud and harsh noises, without making radical changes in the entire structure, it would seem that the only recourse would then be to sink the tracks below the level of the streets. This was done successfully in the case of the Fourth avenue improvement; and now we have through the upper part of the island a structure that will last for centuries and accommodate both local and through traffic, passenger and freight, with a capacity equal to any demands that may be made upon it, and with the least possible annoyance to the residents along the line. It will be no misfortune to the city if the system has to be extended.

AMERICAN AGRICULTURAL EXHIBITS AT PARIS.

Twelve prizes were placed at the disposal of the jury, namely, Sèvres vases, to be used in recognition of such exhibits as were proven to possess exceptional merit. Eleven awards were made; and of these eight were adjudged to American inventors, as follows:

C. H. McCormick's Reaping Binder.
Walter A. Wood's Reaping Binder.
Osborne's Reaping Binder.
Deere's Gang Plow.
Johnston's Harvester.
Whiteley's (Champion) Mower.
Dederick's Hay Press.
Chicago Hay Press.

The latter was exhibited by the French agent in Paris, the others by the parties themselves, being exposants in the American section. The English declined to enter the competition.

A Modern "Prehistoric" Instrument.

The discovery in the lacustrine houses of Switzerland and Savoy, and in the Lake of Bourget, of bronze rods surmounted with movable rings, has called forth explanations from all quarters. Carl Vogt, among others, has come forward in response to M. Mortillet's invitation to supply him with a clew to their use, and according to him we still have a similar instrument in the "Ringelstock" of the German herdsman, which is formed of a stout nut stick, terminating in a lateral branch, on which are hung several metal rings. If the noise is not successful in bringing back the animal, the instrument is thrown at its head with an alarming clatter of bells.

Remarkable Gas Wells in Ohio.

A correspondent of the Cleveland *Leader* says that the natural gas wells of East Liverpool, Ohio, form one of the seven wonders of the world. They are situated in and around the city, and give it a continual supply of the finest light. The gas is almost as free as the air. It costs practically nothing, and forms the illuminator and heater of the town. The city is lighted by it, and the street lamps blaze away at noonday as well as at midnight. It costs nothing to let them burn, and it takes trouble to put them out. Its light is not the flickering mockery of poorly manufactured gas, but a flame which proximates in its brilliancy that of the electric light. Almost the entire fuel used in the town is this gas. It is conducted into the grates and stoves in pipes, and by it all the cooking and heating are done. It is also used in furnishing steam power for many of the largest pottery and ironstone china manufacturing establishments, twenty-two of which are in operation and busily engaged, employing over two thousand hands, and which it is considered justly entitled East Liverpool to be designated as "the ceramic city" of America. Regarding the duration of the supply from these wells it is stated that the first well discovered now burns as brightly as when it was first opened, and for the last twenty years has never flagged in its brilliancy, and none of those now in operation have ever shown any signs of giving out. For years Liverpool used manufactured gas, never dreaming of the rich supply that was wasting away daily under its very feet. The poor quality of the manufactured product induced the opening of the first well in 1859. This well, which is four hundred and fifty feet deep, has been furnishing fuel and light to several houses, producing the steam for a large engine, and burning pottery kilns, every day for over twenty years.

Lighting Sea Beacons from the Shore.

A method devised by J. R. Wigham, and successfully tried by the Commissioners of Irish Lights, consists in extending pipes from the shore under water to the beacon lantern; in the daytime a very small jet of gas is kept burning in the lantern, but at night a full sized light is used, the regulation of the flame being accomplished simply by increasing or diminishing the gas pressure on shore. In the daytime a high pressure is maintained which lifts a valve near the burner and allows only a very small jet of gas to escape, while high pressure prevents the small flame from being easily extinguished by wind. At night, by lowering the gas pressure the valve falls and a large gaslight flame is the result. The labors of boatmen, and the dangers to which they are frequently exposed in stormy weather in lighting beacons, are by this plan saved.

Emigration from Canada.

The Department of State has received a dispatch from our Consul at Port Sarnia, in which the number of emigrants seeking homes in the United States, through that port, for the year ending June 30, 1878, is given as 30,610. Of this number, 16,183 were Canadians from the provinces of Ontario and Quebec. The Canadians were principally agriculturists, carrying with them to their new homes their horses, wagons, agricultural implements, household effects, and, in a majority of cases, money enough to purchase farms. "Hence," the Consul says, "they may be regarded as a very valuable acquisition to the ranks of American industry."

Alizarin Carmine, a New Tinctorial Substance.

This compound, recently introduced into the market as a dye for woolens, is the sodium salt of a sulpho-acid of alizarin. With the ordinary mordants it gives a variety of brown, chocolate, orange, red, and scarlet shades. The latter, though inferior in brightness to cochineal and eosin scarlets, are absolutely fast as against air and light, and are injured neither by soap lyes nor by perspiration. The new color will therefore be well adapted for carpets, hangings, military uniforms, etc.

Arsenic in Sulphuric Acid Pyrites.

In Spanish pyrites, M. E. Hjelt, using A. Smith's method, finds 0·91 per cent of arsenic; in Westphalian, 0·30; and in Norwegian, mere traces. In chamber acid he finds 0·202 of arsenic; in the acid from Glover's tower, 0·331; and in that from Gay-Lussac's condenser, 0·334. The bulk of this arsenic is present as arsenious acid. In the last chamber the acid contains merely 0·019 per cent of arsenic. The mud deposited in Glover's towers consists chiefly of arsenious acid.

THE Manchester *Guardian* says that the excessive heat—120° in the sun at Wigan—had a singular effect on the railway metals between Wigan and Manchester, on the London and Northwestern line. Near Plat Bridge station the up line to Manchester was found bulging for eight lengths in the shape of an S, the metals and sleepers having been bodily moved at one point nearly two feet. The rails appear to have been set too tightly, and on the heat expanding them they had been twisted out of their original course.

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THE MANUFACTURE OF THE CHICKERING PIANO.

[*Continued from first page.*)

heit. From the stock room the next step is to the case room, where it is fashioned into the different styles of cases. When complete the cases are transferred to the sounding board room, where the sounding boards are placed in position. This is an extremely important stage in the manufacture of a first class pianoforte. The preparation of the wood for the sounding board, and the manner of its arrangement, demand the greatest nicety, skill, and care that wood from the same sections of the log shall come together and that there may be no dissimilarity of grain. The proper distribution of the bars that equality of vibration may be secured, and the grading of the bars, call for consummate skill and judgment. Of course, in the manufacture of cheap pianos, so called, none of this costly care and developed experience can be employed; and the natural consequence is that it is a mere chance that an instrument of that character should be respectable as an instrument.

From the sounding board room the cases go to the varnishing room, where six of their seven coats of varnish are applied, allowed to dry, and rubbed down one after another, until the surface is solid. Two more departments have to be gone through before the perfect piano is transferred to the wareroom for sale—the stringing room and the finishing department. In the latter the various parts of the action are placed in position, and the pianos receive three or four of the necessary tunings, to secure proper tension of the strings. Here, too, the action receives what is technically styled rough regulation. The subsequent polishing of the exterior, and the subjection of every part to the most careful scrutiny, complete the work.

Our illustration of this room (Fig. 3) conveys some idea of the magnitude of the operations carried on in the Chickering manufactory.

The preparation of the iron frames constitutes a special department of the manufacture, and is necessarily a most important one. Every part is subjected to a test which determines its perfection of aggregation and its tensile strength. The action room (Fig. 5, page 259) is one of the most interesting departments in a well regulated manufactory. Here every portion of the wood used is kept in stock for years. The wood of which the Chickering piano actions are made has been cut up to dimension sizes for at least ten years—a very different process from that employed by the makers of cheap instruments, who purchase their action parts by the barrel, and put them together, so to speak, on the run.

Some of the machinery employed in the action department of the Chickering manufactory is as delicate as that used in the manufacture of watches, and constant care is taken to secure uniformity in the making and adjustment of the delicate pieces of which the actions are composed. Indeed, from the spacious and magnificent engine room (Fig. 1, first page), throughout the entire establishment, the perfection as well as the great variety of machinery employed compels the admiration of every visitor. The processes represented in Figs. 2 and 4 (pages 258 and 259), namely, string winding and machine carving, do not require special comment. Messrs. Chickering & Sons cordially invite all who may be interested in the manufacture of pianos to visit their factory in Boston. It is, they claim, the largest establishment of the kind in the world, and the most complete in everything necessary to the production of what has become a prime necessity of modern cultured life. The warerooms and Concert Hall of Chickering & Sons, in New York city, are located on the northwest corner of 18th street and Fifth avenue. This beautiful building has a frontage of 79 feet on the avenue and 135 feet on 18th street. It is one of the most conspicuous and commanding edifices in New York. The entire first floor is exclusively devoted to the exhibition and sale of the pianofortes manufactured by Chickering & Sons. The main entrance to the warerooms and music hall is through a magnificent arched door of 14 feet in width to a vestibule 24 feet in width, from which leads the capacious staircase of 14 feet in width directly to the lobby of the music hall. The hall is 107 feet long by 75 feet wide and 48 feet high, and has nearly one thousand five hundred numbered opera chairs. It is lighted by twenty-five crystal reflectors on the ceiling and by a line of brackets extending around three sides of the hall; this hall is the most brilliantly lighted one in the world, and certainly the best ventilated. The hall, as well as the entire building, is heated by steam, and is as nearly as possible fireproof. The seating arrangements are admirable. A rise of two feet in the parquet and of two and a half feet in the parquet circle gives every auditor a fine view of the stage from the lower floor, while the balcony, which extends around the entire three sides of the hall, is certainly one of the most delightful auditoriums in the world. On each side of the stage, which is large enough to accommodate an orchestra of eighty, is placed a magnificent organ, by Roosevelt, the celebrated builder, thus rendering this hall the most complete as well as the most beautiful and comfortable of its size in the world.

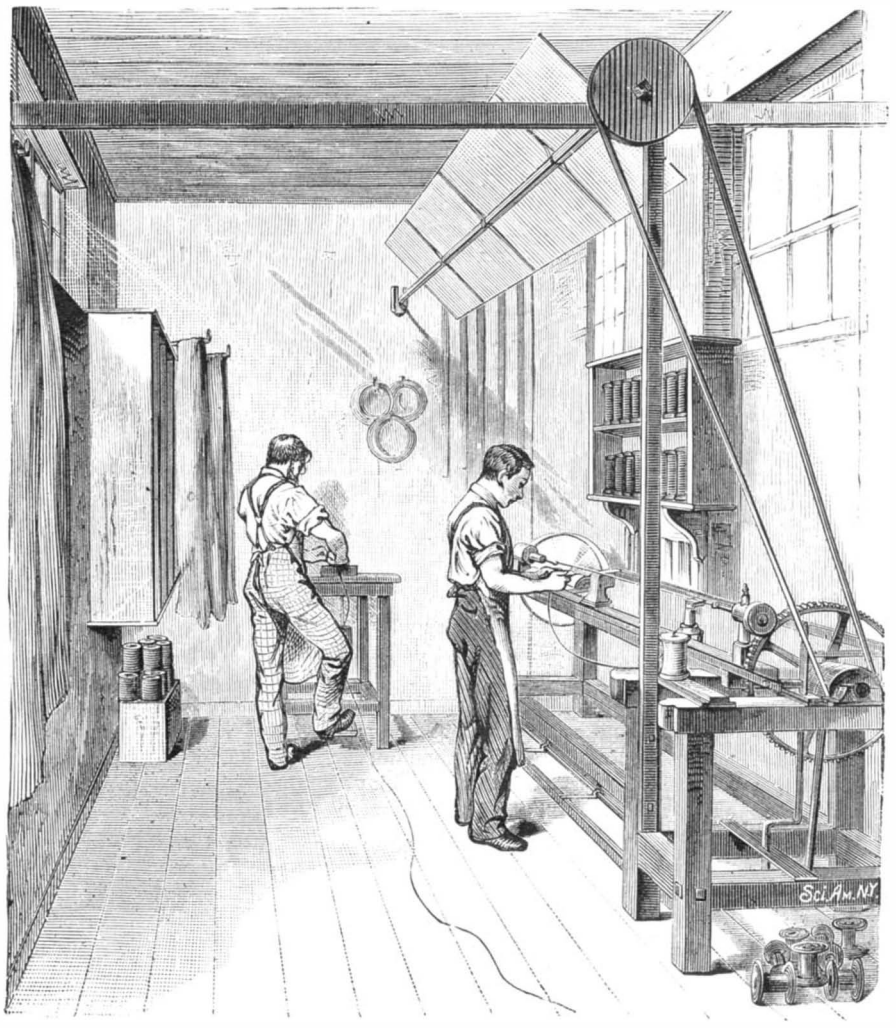

Fig. 2.—THE CHICKERING PIANOFORTE MANUFACTORY.—STRING WINDING.

Tools for Young People.

Buy tools for your boys, and if you have no boys, buy tools for your girls. It will not harm any girl to learn to drive a nail or saw a board and do it well, and if she knows how she will, without any doubt, many times find it convenient, no matter what may be her fortune in life. For every one it will be a great advantage to cultivate mechanical skill—no one has too much of it. Nothing will be handier or be acceptable on more occasions than to know how to use a few common tools. To begin

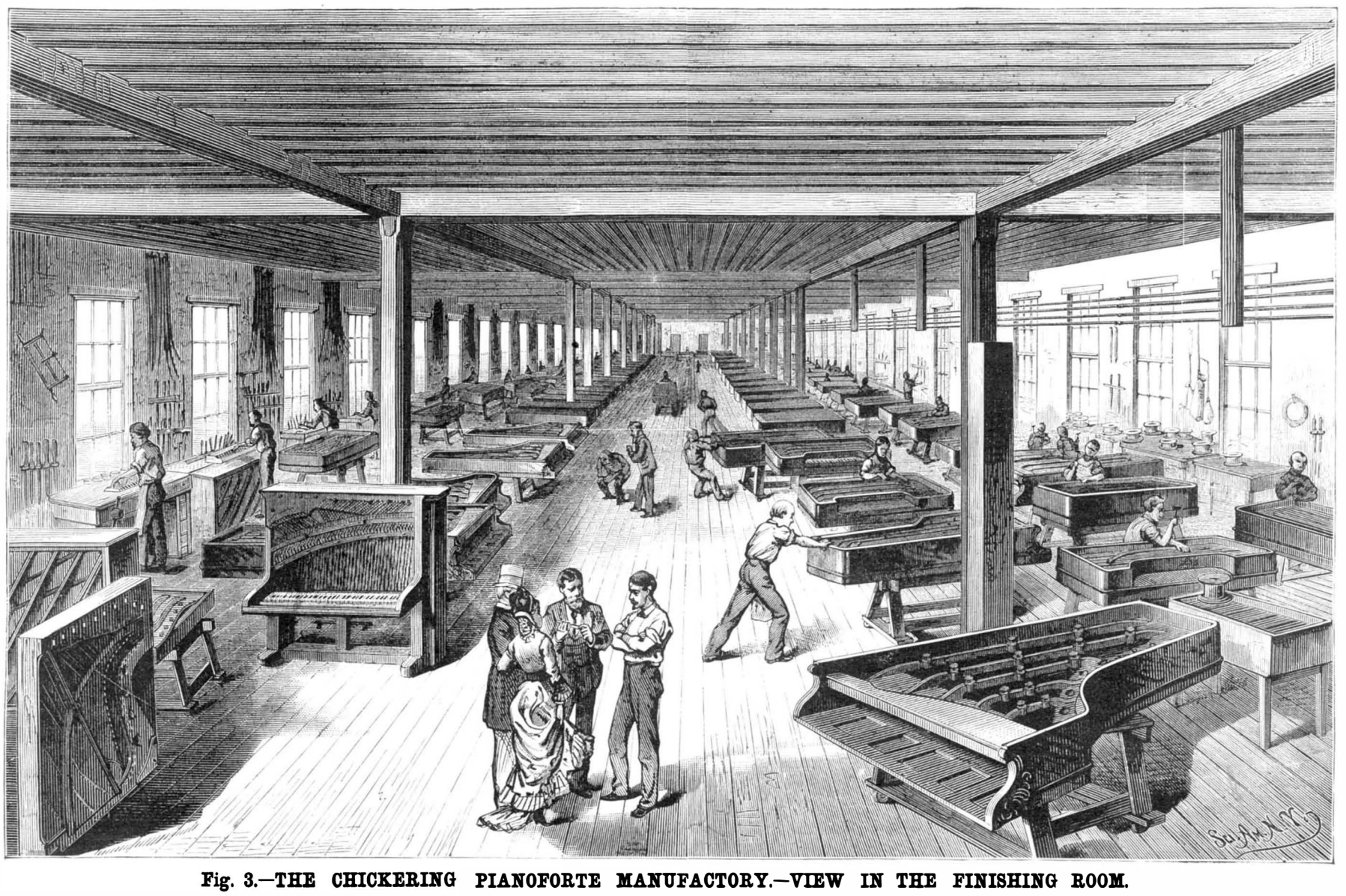

Fig. 3.—THE CHICKERING PIANOFORTE MANUFACTORY.—VIEW IN THE FINISHING ROOM.

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with, the outfit need not cost over $10, but we will say $25. For this he may buy a square, a jack-plane, a smoothing plane, a hand axe, a hammer, a draw shave, some dividers, a bit stock and half a dozen bits, a half dozen chisels, a bench screw—a small bench he can make; a few files, a whetstone, a hand saw, a rip saw, a screw driver. Then with the rest of the $25 he can buy a little wire, an assortment of screws, a few of a kind, an assortment of nails, and a small quantity of pieces of board of various dimensions. The tools should be of good quality. In a little time some of these will be lost or broken, but what of it? So is money lost and thrown away. It is a profitable training for every one to learn how to use money properly. To learn, they need to begin early under good instruction. Twenty-five dollars in money may be spent in a thousand ways for things which will do less good than the tools. Although this may seem to some a large amount to pay for tools, $25 would be considered a small item as an inheritance for a young man. Then buy the children some tools, and they will learn to make many playthings for themselves, and be less likely to get into bad company. They will be happier, wiser, better; they will have a stronger attachment for home, and a greater love for parents, and these are a priceless fortune to any young man or woman, a fortune which cannot be lost by any failure of banks or depreciation in real estate.—*Rural New Yorker.*

Lead Salts and Ammonia.

Dr. Méhu, in a paper recently read before the French National Academy of Medicine (*Journ. Pharm. Chim.*, xxviii., 159), announces that the use of lead salts for the removal of the pigmentary matter from urine, bile, fæces, and other animal and vegetable secretions may be advantageously replaced by that of sulphate of ammonia. Usually it is necessary to first acidify the liquid to be treated with sulphuric acid; the sulphate of ammonia then being added to saturation precipitates the whole of the coloring matter, which can be separated by filtration. In like manner, sulphate of ammonia added to milk causes the complete separation of the albumen and butter, leaving the whey limpid and colorless and suited for a saccharimetric examination. In the case of milk the previous addition of sulphuric acid is not necessary, but a slight acidification renders the coagulum more compact and facilitates the filtration. Sulphate of ammonia does not precipitate gum, sugar or tannin; in fact Dr. Méhu has used it to separate the chlorophyl from a solution of commercial tannin.

American Science.

There are two names in the extended and honored list of American savants which every student regards with the highest respect and pride; we allude to Professor Gray, of Cambridge, and Professor Dana, of Yale. These two investigators in different fields have done more to make American science respected the world over than any others; and they may be justly regarded as the highest living authorities in the departments of science in which they have labored. The great works to which they have devoted their lives are standard and authoritative among educated men everywhere, and will continue to be long after their authors have passed away. The "Mineralogy" of Dana, and Gray's "Botany," form as thorough and exhaustive compendiums of two departments of science as the present stage of learning affords. They are vast storehouses in which are hoarded the ripest scholarship and the results of the widest researches of the age.

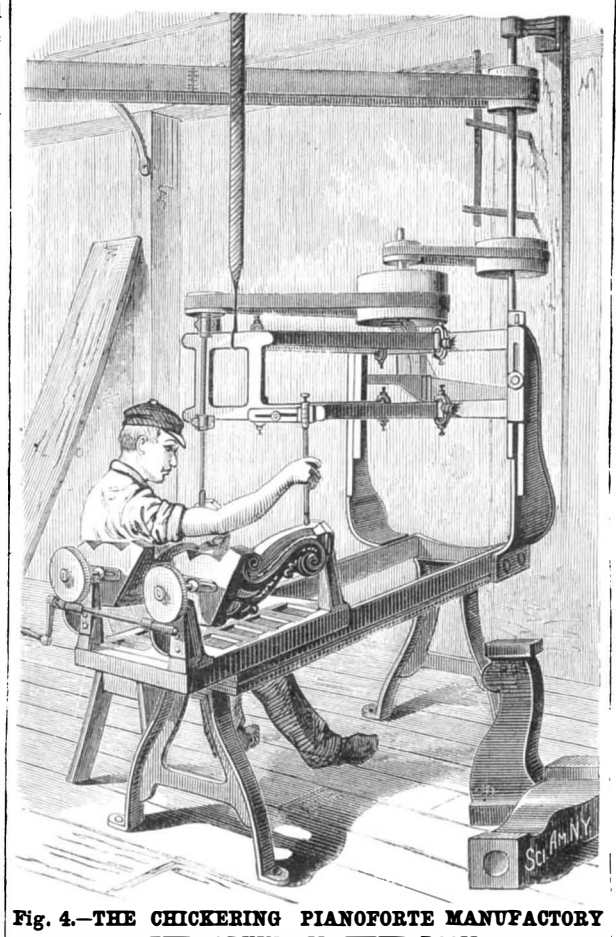

Fig. 4.—THE CHICKERING PIANOFORTE MANUFACTORY—THE CARVING MACHINE ROOM.

These two distinguished men are now in the evening of life, but still hard at work. Every hour of every day finds them either in their cabinets among their rare collections of specimens, in the field, or at their desks; and we can only hope that life and strength may be spared to them for many years, that they may make further and even richer contributions to human knowledge. Great learning and exhaustive intellectual labor, as far as our observation extends, do not produce unsocial habits of life, or pride of position, or arrogance; on the contrary, the truly great man, in science or literature, is in a marked degree genial and condescending. The men under consideration are in social life simple, modest, kind, generous, approachable. Such noble natures have no place for the pedantries and follies which environ little minds, when fortuitous circumstances bring them into notice. The earnest seeker after knowledge, however humble or untaught, never meets with rude rebuffs from the truly learned; they are the helpers and patrons of the lowly, if capable and honest.

It is not unusual to honor in some public manner our distinguished poets and literary writers at certain important epochs in their lives, and we know the suggestion that in like manner we remember those who by their researches in science have shed such high honor upon the American name will be gladly received. It is true, no garlands we can weave will add to the luster of the names of our great scientists, but some appropriate mark of public appreciation of their labors and acquirements it would be delightful to bestow—a delight which might not be denied us by those so deserving of our homage and respect.—*Boston Journal of Chemistry.*

A Curious Astronomical Observation.

To the Editor of the Scientific American:

While observing Jupiter on the evening of the 28th September, at about 8:30 o'clock, with a small telescope of 3 inches aperture, power 150, I noticed a black spot, round and distinct, on the northerly dark central band. It was about the size of the largest satellite, but as the four satellites were all visible at the same time, two to the east and two to the west of the planet, it did not seem possible to be the shadow of any of them, particularly as no transit was noted for that evening in your "Astronomical Notes." I am no astronomer, but take a great deal of pleasure in observing the heavenly bodies, and would be much obliged if any of your readers could afford me some explanation of what seemed to me a singular phenomenon.

JOHN H. EADIE.

Green Ridge, Staten Island, N. Y.

Marking Ink Without Nitrate of Silver.

One drachm of aniline black is rubbed up with 60 drops of strong hydrochloric acid and 1½ oz. of alcohol. The resulting liquid is then to be diluted with a hot solution of 1½ drachms of gum arabic in 6 ozs. of water. This ink does not corrode steel pens; is affected neither by concentrated mineral acids nor by strong lye. If the aniline black solution is diluted with a solution of 1½ oz. of shellac in 6 oz. of alcohol, instead of with gum water, an ink is obtained which, when applied to wood, brass, or leather, is remarkable for its extraordinary black color.

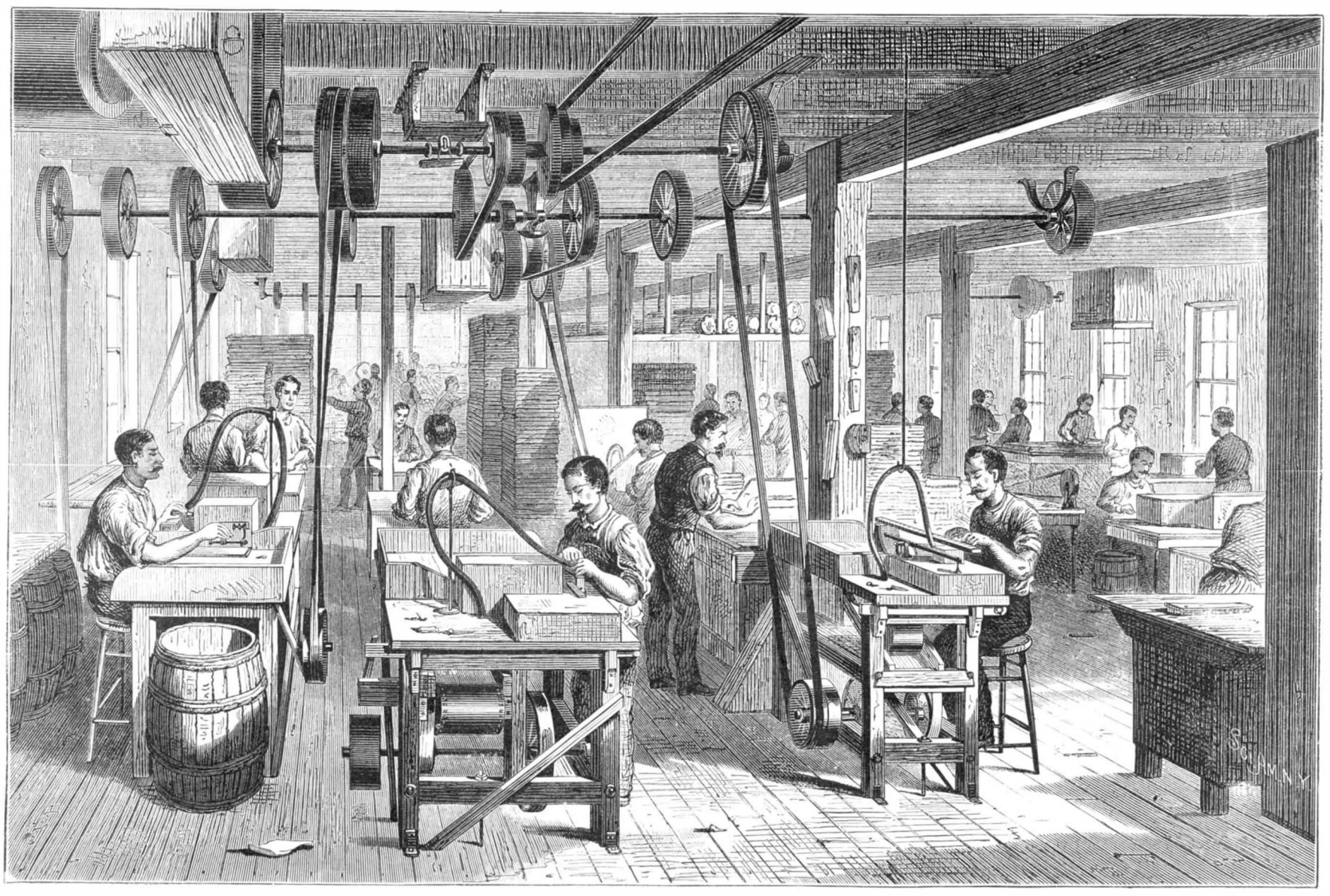

Fig. 5.—THE CHICKERING PIANOFORTE MANUFACTORY.—VIEW IN THE ACTION ROOM.

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PNEUMATIC APPLIANCES FOR MINES.

A fruitful source of danger and a constant bill of expense, even under the most favorable circumstances, are involved in the style of hoisting apparatus in common use in our mines; and that these conditions are greatly aggravated by frequent fires and other accidents, is the painful experience of all miners.

As whatever promises to remove or abate these evils possesses general interest, we give a brief description, condensed from the *Revue Universelle*, of the pneumatic system of hoisting in mines, in successful operation at the mines of the Epinac Mining Company, in France, a system combining so many eminent advantages that it must ere long be generally adopted here.

The idea of applying compressed or rarefied air for hoisting the cars from a mine, in a closed tube, by means of a piston, is old. For depths of 1,200 to 1,600 feet cables and hoisting machines suffice for a large output, though they are open to the objections stated above; but as the mines become deeper the difficulty increases, the dimensions which must be given to the machines and the ropes become enormous. and the number of trips made by every cage, in twenty-four hours, decreases rapidly.

The velocity which must be given to a piston in a tube is by far greater than any speed which can possibly be acquired by rope without peril.

The main point, however, is that in the pneumatic system the dead weight remains constant, whatever may be the depth reached. If two connected tubes are used instead of a single one, the dead weight is entirely done away with, as the pistons and cages balance one another, supported as they are by a column of air weighing almost nothing, instead of being suspended from a rope which is heavy and cumbersome, and is exposed to a break at any moment. The elasticity of atmospheric propulsion seems a guarantee against any accident.

There is a deficiency in the motive power of the Epinac plant, as the machine can only exhaust 36 cubic feet a minute, but a more powerful one is now building which will do at least ten times as much, and reduce to two minutes the time required for the ascension of a car from the depth of 2,000 feet.

As it is working now, the system has furnished an output three times greater than that which the same motor, working with ropes in the ordinary manner, could yield.

Hoisting by means of a pneumatic tube calls for a plant composed of three principal parts: the machine for exhausting the air above the piston, the pipe passing through the whole shaft, and the piston which carries the cars. At the Hottinguer shaft, near Epinac, the tube is composed of 674 rings of sheet iron and 18 special cast iron rings which are destined to receive the accessory apparatus. The diameter of the tube is 5¼ feet, one ordinary ring weighing about 11,000 lbs. Each one is made of one sheet, the edges being riveted together, with the inside heads countersunk.

The horizontal joints are made of angle iron, 2½ inches wide and 0·56 inch thick, with countersunk rivets. This angle iron, therefore, forms flanges, which are connected by 60 bolts. Rubber rings are placed between the joints to make the tube air-tight and to permit some play for variations of temperature. The door rings are 0·56 inch thick, and are furnished at opposite sides with doors which allow the cars to go in or out. They have a vertical sliding motion. The valve rings are very similar to the sliding sluice valves of gas mains. The tube is braced against the timber of the shaft, and is furnished with various accessory attachments, such as brackets, cocks, valves, working and equilibrium pipes, barometers, and safety valves. The safety valve pipe starts from the bottom of the tube and leads to the open air, where a valve is attached which may be closed at will; with its aid the speed of the piston in rising or descending may be regulated.

The upper piston carries the cage which holds the car; below the cage there is another piston which is called the lower piston. The upper piston is double, the two parts which compose it being so far apart from one another that the distance exceeds the height of the doors. The lower piston has a valve which is opened when the car carries passengers.

At the charging and discharging stations the full cars are placed or taken off in three movements, which are effected in the most simple manner by opening or closing the admission or escape valves of the air.

This system has been working at the Hottinguer pit for eighteen months without any injury to the tube or the cages, and without any repairs. Besides a saving in fuel this system possesses the advantage of leaving the shaft open for inspection, repair, etc. The disadvantages connected with ropes, the danger of their uses, and the expense of their frequent renewal disappear entirely.

The ventilation of the mine is also increased, and the hoisting apparatus may be made a valuable adjunct of the ventilators when a strong barometric depression makes the danger of fire-damp greater than usual.

We would add that if this system were applied generally to warehouses and hotels we should happily have to record fewer destructive fires and fewer accidents to life and limb for which the present style of elevator is responsible.

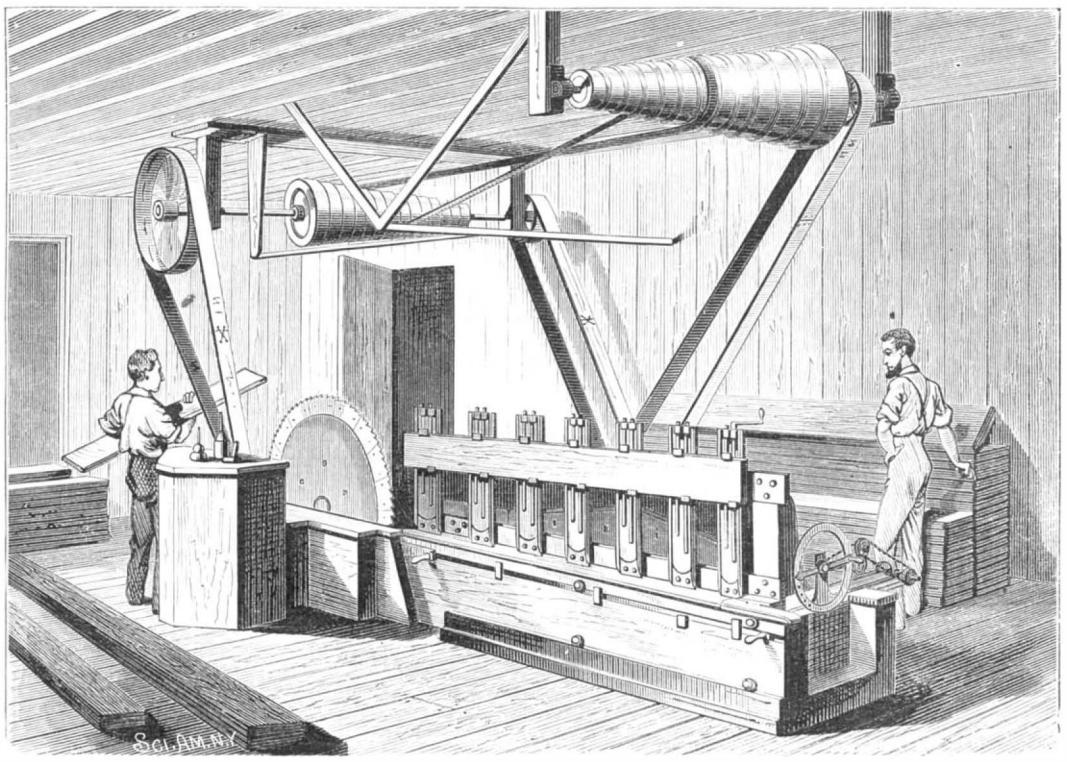

Fig. 6.—THE CHICKERING PIANOFORTE MANUFACTORY.—THE VENEER SAWING ROOM.

The Transplantation of Tissues.

A series of systematic experiments on the transplantation of tissues has, says the *Lancet*, recently been carried out by Dr. Zahn. The first observations were made on the transfer of hyaline cartilage from one adult animal to another. The tissues into which the fragments were implanted were the subcutaneous connective tissue, the anterior chamber of the eye, the submaxillary glands, the kidneys, the testicles, and the blood vessels. These attempts yielded, however, negative results; the cells of the tissue perished, the intercellular tissue persisted, but the fragment became encapsuled by connective tissue. The experiments were much more successful when the fragment was taken from fœtal cartilage, which showed a remarkable capability of developing in another organism, even in that of an adult animal. If some cartilage were rubbed up with amniotic fluid, the smallest quantity of the mixture produced, in about six weeks, nodules of cartilage the size of a lentil seed. On injecting this mixture into the jugular vein, numerous growths of cartilage were subsequently found in the lungs. The capacity of fœtal cartilage to develop is so great that these results were obtained not only with animals of the same species, but even with those of different species. For instance, cartilage from the fœtus of the cat gave rise to nodules in rabbits. Experiments were also made with the cartilage from an enchondroma, with less uniform success than with fœtal cartilage, but with much more success than with ordinary adult cartilage. In several instances the attempts to transplant it were successful. This is, it is hardly necessary to point out, a result of much interest in connection with the diffusion of enchondromatous growths. With other fœtal tissues Zahn was also successful. A piece of growing bone, for instance, became connected with the bloodvessels of the tissue into which it was placed and became nourished. Entire bones were even thus implanted, and, although they did not grow as a whole, they preserved their form, and outgrowths occurred—exostoses and enchondromata—at both the epiphyses and diaphyses. From these experiments, and those of previous investigators, Zahn concludes that only fœtal tissues, and such adult tissues as preserve their fœtal peculiarities, can develop in another animal, or in another part of the same animal. Only, for instance, the red marrow will do so, and the periosteum of young individuals. Such tissues alone possess the capability of persisting until they have come into relation with the new organism.

Gas Light.

At the British Association the report on the best means of developing light from coal gas, by Dr. Wallace, of Glasgow, was read by Dr. Wills, F.R.S. He approved the use of cannel rather than common gas on account of its comparatively small influence on the atmosphere of apartments, and the smaller proportion of sulphur it contains. He also recommended that gas be formed at low pressure, and that district governors be used to ascertain the pressure at different levels in towns. He mentioned the fact that the average illuminating power of gas delivered by the Scotch companies was 26 candles, whereas in London it is only 16, and in the chief cities and towns of England and Ireland only 14. The use of globes round light reduced the quantity 10 per cent.

The Absorption and Excretion of Water.

The absorption of water from the alimentary tract is a subject to which less attention has been directed than its practical importance deserves, for the subject is not so simple as might at first sight appear. Dr. Skorczewski, of Cracow, has, says the *Lancet*, made an interesting series of observations on the relation in time and quantity between the absorption of water and the excretion of urine, and his results have been published in a Warsaw journal. The observations were made upon men and rabbits, and in the latter provision was made to secure the urine as soon as it passed into the bladder. Spring water, soda water, and certain Russian mineral waters (those of Krynica and Iwonicz) were employed in the observations. The following conclusions were reached. After the injection of spring water the quantity of urine did not increase immediately, in the case of either men or rabbits, but rose after a certain time, which is said to have been the longer the more water was taken. A longer period elapsed after the spring water than after the mineral water before the increase in the urinary secretion occurred; and the more spring water was taken the longer was this interval, and the more mineral water the shorter was the interval. The increase in the urinary secretion reached its height sooner after the mineral water than after spring water. The greatest total effect on the urinary secretion was obtained by soda water, the next with spring water, and the least with the mineral waters. The quantity of urine was in each case smaller than the quantity of water ingested, with the exception of that which was saturated with carbonic acid. The difference between the total quantity of liquid taken and the total quantity of urine excreted was less after ordinary spring water than after the mineral water.

A second series of observations had for their object to ascertain the relation in time and quantity between the water absorbed and the urine excreted. This was effected by killing rabbits at certain periods after the water was injected into the stomach, the excretion of urine being observed in the same way as before. From these observations it appeared that the increase in the excretion of urine did not commence until after the whole of the water had been absorbed, and in the case of both small and moderate quantities of water (40 to 100 c.cm.) a period of ten or fifteen minutes passed after all the water had been absorbed before the effect on the urine was apparent. It is calculated that 500 cubic centimeters of water is absorbed from the human stomach in fifteen minutes, and 200 c.cm. in five minutes. These results are true, however, only of spring water. Mineral water behaves differently. The increase in the excretion of urine occurs the earlier the slower the absorption progresses. By the exclusion of certain possible causes for this difference, such as altered pressure in the abdominal cavity, direct irritation of the splanchnic nerve, or the effect of blood tension, the conclusion is reached that the cause is the alteration in the blood consequent on the admixture with it of the saline substances in the mineral waters, the change in the blood acting as a stimulant to the vaso-motor nerves.

Whatever be the precise value of these researches, they show conclusively that the function of the stomach and kidneys may be materially affected by the presence of very small quantities of saline substances, and they indicate how much caution is necessary in applying rules true of pure water to water which we are accustomed to consider as differing from spring water by very trifling qualities. As an instance of the practical importance of these facts, it is evident that the saline waters, so commonly taken with food, remain in the alimentary canal for a much longer time than spring water, and are capable therefore of disturbing in a greater degree the process of digestion.

U. S. Surveys of South American Rivers.

The U. S. steam sloop-of-war Enterprise, after an absence of five months, surveying the Amazon and Madeira rivers, in South America, returned to the Brooklyn Navy Yard September 26. Her commander, Thomas O. Selfridge, was in command of the Darien Survey Expedition in 1871–2. He reports having had a successful expedition. They took a complete range of soundings at five minute intervals throughout the day, which, together with frequent observations, will insure correctness of the charts. The survey extended from the mouth of the Amazon and up the Madeira to the falls. For a distance of 500 miles up the Madeira river the water was navigable for vessels of 20 feet draught. Near the mouth of the Madeira the Amazon was about a mile wide and 60 feet deep.

Compressed Tea and Coffee.

Tea and also ground coffee are now compressed into cakes by hydraulic presses. The method, it is said, makes them more readily transportable and unalterable for a length of

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time. The coffee is subjected to a pressure of from 40 to 70 atmospheres in suitable cast iron moulds. The coffee is thus made to assume a tabular shape, and comes into the market in a form resembling chocolate, divided as the latter is by ribs to facilitate breaking into pieces of suitable size for use. The interior surface of the moulds is highly polished, by which artifice the outer crust of the compressed coffee is made sufficiently smooth and hard to prevent the tendency of the ethereal oil of the coffee to escape from the interior of the cakes. The volume of the coffee thus prepared is reduced to less than one third of that of the original. Tea and coffee thus compressed can be packed and transported in tin foil or other packages, preserving their aroma indefinitely.

THE ALHAMBRA.

When a thing of special excellence appears on the market there are many who stand ready to assert that the climax has been reached and that it is useless for inventors to look further in that direction; but the folly of such conclusions is every day proved, and we are forced to believe that no human production is so perfect that it may not, in one way or another, be improved.

In the manufacture of stoves one would have thought it difficult to improve the already existing forms either in design or manner of operation; but in our engraving is represented a fireplace stove, called the "Alhambra," which possesses several novel and valuable points. It not only is an economical and effective heater, but it also is an admirable ventilator. The impure air is drawn into the stove and consumed or escapes through the chimney. The cold air enters the lower part of the stove and passes upward between double walls and escapes, warmed, into the room. An upper room may be warmed by removing the top urn and replacing it with a hot air pipe, which may extend to a register in the floor above.

Owing to its peculiar construction the Alhambra is a successful soft coal burner. It has a combustion chamber back of the fire grate, in which the carbon and gases emitted from the burning coal are consumed, thus avoiding condensation and preventing the formation of the heavy black smoke and fine particles of soot, the usual accompaniments of the combustion of soft coal.

The inventor says that the combustion is so complete that no matter what the length of the pipe or chimney may be, there is neither condensation nor accumulation of soot.

It is stated that a ton of soft coal burned in this stove develops as much heat and lasts as long as a ton of hard or anthracite coal consumed in stoves of other forms, and is capable of burning hard coal with the same facility as the soft.

Open fireplace heaters are made on the same principle and are designated by the same name. These heaters are made to set under the mantel, and are provided with an air chamber behind and above. It combines the principle of air warming of the ordinary fireplace heater with the heating and ventilating principles of the common grate. It has a summer front and blower, which slides back from the center of the front into air-tight iron pockets.

Both forms of this heater have direct and reversible smoke flues, also a double swing hearth and side niches for the poker, shovel and tongs.

The Alhambra was recently patented by Mr. A. T. Bennett, of 101 Lake street, Chicago. Further information may be obtained from the patentee or from Mr. A. P. White, P. O. Box 20, Chicago, Ill., and the stove may be seen at the American Institute Fair.

THE FIREPLACE STOVE ALHAMBRA.

New Inventions.

Mr. Aaron J. Mershon, of Warsaw, Ind., has patented an improved Rock Drilling Machine. This invention relates to certain improvements on the rock drilling machine for which letters patent No. 190,232 were granted to the same inventor May 1, 1877; and it consists in combining with the drill shaft, its lifting arm and the slotted disk wheel, an arm and springs, whereby greater force is applied to the drill on its descending stroke.

Mr. Willis D. Riddick, of Belvidere, N. C., has patented an improved Baling Press, which is particularly intended for pressing cotton, but it may be employed for baling hay and other substances. It consists in an arrangement of a plurality of windlasses, which are so contrived that great pressure is obtained with a small outlay of power.

Mr. James K. Johnston, of St. Louis, Mo., has patented an improved Burglar Alarm. This invention is an improvement upon the device for which letters patent No. 192,698, dated July 3, 1877, have been issued to the same inventor. The object is to provide a stronger, more compact, and also more efficient device.

Mr. Joseph Forman, of Helena, Ky., has patented an improved Car Coupling, which consists of a lever arrangement for raising and dropping the coupling pin from the side or top of the car; and in a swinging and guided frame for lifting the coupling link from the top or side of the car, so that it properly enters the mouth of the connecting draw head.

An improved Razor Strop has been patented by Mr. George W. Brown, of Cumberland Mills (Westbrook), Me. This invention relates to that class of razor strops that are coiled within a case by the action of a spring, and it consists in arranging a spring roll and friction roll with respect to each other, and to an opening in the case, so that the working face of the strop cannot come in contact with the surface of either roll.

Mr. Perry Dickson, of Spearfish City, Dakota Territory, has patented an improved Irrigating Apparatus, by which the water may be distributed at any degree of temperature over the ground, either for the purpose of melting the snow and taking the frost out of the ground, or for scalding the seeds of weeds and killing worms, grasshopper eggs, and other insects, or for accelerating the growth of the plants, when the ground is prepared, by distributing water in a warm state during the cold nights, so as to supply a sufficient degree of heat to the ground, whereby the growing of the vegetables and other plants is accelerated in a high degree.

An improved Scarf has been patented by Mr. Morris Henschel, of New York City. The object of this invention is to furnish for scarfs of all kinds an adjustable center piece, which may be readily adjusted whenever its edge is worn out or soiled, so as to expose a new and unsoiled edge and impart to the scarf a neat and clean appearance until it is entirely worn out.

An improved Brake for Railway Cars has been patented by Mr. Willard R. Green, of Muscatine, Iowa. This invention consists in a novel arrangement of coupling mechanism, connecting rods, and various other devices, in connection with the brake mechanism, whereby provision is made for operating the brakes of all the cars in a train by power applied from the engine.

Mr. Richard Pattin, of Marietta, Ohio, has patented an improved Breast Collar, which is so constructed as to work easier upon the horse than breast collars constructed in the usual way, and which may be placed higher up, so as to be in the most favorable position for the horse to apply his strength to the draught.

Mr. S. Hinckson Bradford, of New York City, has patented an improved Tin Can for condensed milk, paints, and other articles. It has the advantage of being provided with a hinged lid, so that the lid may be raised or lowered with great facility and the contents of the can protected effectively against dust and flies.

Mr. Miles Puckett, of Walesca, Ga., has patented an improved Washing Machine, which is simple in construction, convenient, and effective. It will wash the clothes without injuring them, and with a comparatively small amount of labor.

Mr. Benjamin F. Buxton, of Brookfield, Vt., has patented an improved apparatus by which moist rubber and other boots, shoes, mittens, and similar articles may be dried perfectly, without any objectionable odor in the room. It consists of a box having a draught tube connected to the chimney and botton tubes with lower perforated elbows, adjustable end pieces, and suspension devices for the boots or shoes, so that the draught established at the interior draws off the moisture and odor.

Mr. Joseph W. Blosser, of Sarcoxie, Mo., has patented an effective Catarrh Remedy, to be utilized either in the form of small cakes by chewing, or in the form of medicated fumes by smoking it like tobacco in a pipe or cigarette, and inhaling, swallowing, or blowing out the smoke through the nostrils, or as the state and location of the disease may require.

An improved Horse Collar has been patented by Mr. Andrew D. Martin, of Abbeville, La. This collar is made by winding moss, hemp, flax, or cotton twine or cord around a flexible base, such as rope, until it is of the proper shape and proportions for a horse collar, when the rope is bent around to the required oval shape and the ends secured. The shoulder for the hames is formed by winding twine evenly upon a base similar to the collar, but smaller, and attaching the rope thus wound to the inner edge of the main collar.

Messrs. Loren M. Webb and Edwin Tinker, of Tuscarora, N. Y., have patented an improved Car Coupling, in which the coupling pin is guided in a cylindrical pin guide or barrel at the top of the draw head, and supported by an extension of the sliding front plate until the same is pushed back by the link. Transverse ribs at the face of the front slide plate serve to hold the link in position for coupling, while a hand lever that engages one of the side plates sets the ribbed front plate forward or backward on the center guide block.

Mr. Thomas C. Veale, of New York City, has patented an improved Combination Barrel. The foundation of the barrel is made of a single thickness of veneer, and in one or more pieces, the edges of which are jointed to each other, and the joints or seams are covered upon the outside with strips of muslin cemented to the veneer. The barrel is covered with a coating of cement, glue, or other suitable adhesive, and is then wrapped with paper, which has been coated or saturated with cement long enough to have swelled. The cover or head is formed of two thicknesses of wood, of unequal diameter, and is applied in a novel manner.

An improved Spring Seat for Wagons has been patented by Mr. John B. Gorrell, of La Otto, Ind. The object of this invention is to improve the construction of that class of wagon seats which are supported upon spiral springs, so that they shall not be dependent upon the springs to steady the seat, but the latter may be firmly supported and yet suspended so as to allow of its free oscillation laterally to counteract the effect of the jolting movements of the wagon.

Mr. Montgomery R. Davis, of Jackson, Mich., has patented an improved Spring Bed Bottom, which is simple and easily adjusted, so as to make it wider or narrower.

Mr. Joseph Adams, of Washington, D. C., has patented an improvement in Gas Regulators designed to increase, diminish, or entirely cut off the supply of gas in an automatic regulator from any portion of the building, and without descending to the meter or place where the regulator is, and designed also to obviate leakage of gas in the regulator.

THE village of Kollmar, near Gluckstadt, in Holstein, which is situated in a district reputed for its healthiness, has just witnessed the diamond wedding, or the 75th marriage anniversary, of two of its 1,400 parishioners. Two more diamond weddings are impending, and the last fourteen years have seen ten such celebrations there.

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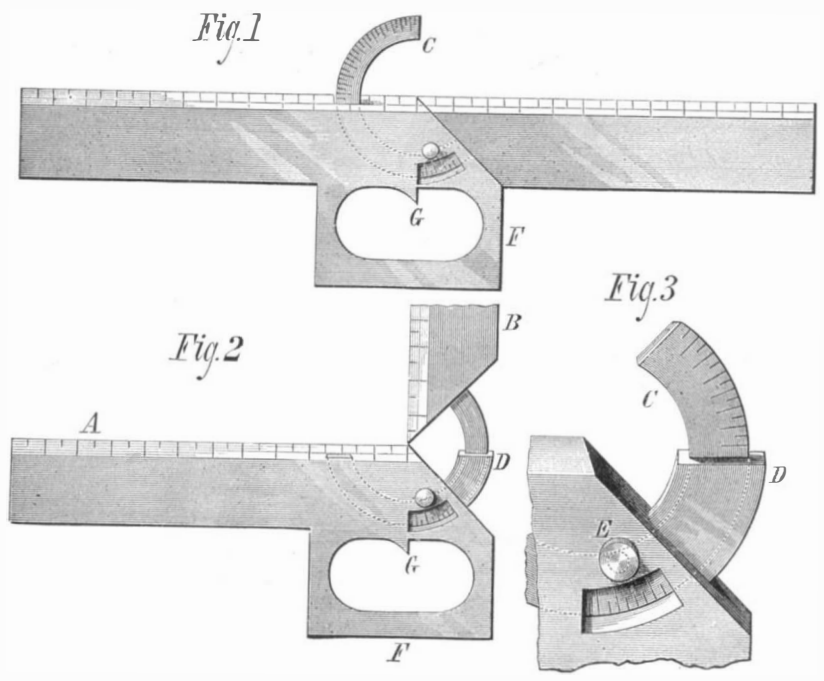
NEW PROTRACTOR.

A useful instrument for the use of draughtsmen and mechanics is represented in Figs. 1, 2, and 3 in the accompanying engraving. It may be employed as a protractor, triangle rule, centrolinead, bevel, rafter and brace scale, etc. It consists of two straight rules connected by a curved slide, so that they may be closed together or opened out on a straight line, so that any angle, up to one hundred and eighty degrees, can be laid off. The two straight rules, A B, have one edge beveled and graduated. The graduations run from the inner ends of the rules outward, and both rules are of the same length along their beveled edge.

A curved slide, C, which forms nearly three fourths of a circle, is secured to the rule, B, and has upon its face graduations suitable for the laying out of angles. The curved piece runs through a dovetailed opening in the rule, A, through which it moves freely. A curved guide, D, projects from the rule, A, for receiving the slide, C, and it has an opening through the top so that the graduations on the curved slide may be readily seen. At one side of the opening there is a scale corresponding to the scale on the curved slide. By means of these scales the two rules may be adjusted at any desired angle, and when so adjusted the slide, C, may be clamped by the binding screw, E.

The rule, A, has an apertured extension, F, which is designed to slide along a graduated rule or straight edge, and it has a point, G, one side of which is straight and forms a line with the inner end of the rule, B, and serves as an indicator to measure off distances on a rule when parallel lines are drawn at certain distances from each other. Address the patentee, Mr. F. L. Cook, Fairfield, Iowa.



COOK'S PROTRACTOR.

Arsenic.

According to the London *Mining Journal* a great deal of poison can be had for a very little money in England. It says, a parcel of arsenic, about 10 tons in weight, was sold at South Wheal Crofty, recently, when the private buyer offered. £4 4s. 6d. per ton; the Cornwall Arsenic Company, £4 7s. 9d.; and the English Arsenic Company, £5 0s. 9d.; which is about 15s. per ton advance on previous prices.

TRUE TIME REGULATOR.

Ordinary clocks have been made to indicate only the mean time, according to which—were the velocity of the earth uniform—the sun should pass the meridian always at twelve o'clock. This would be the case if the sun were always in the extended equatorial plane; but the sun being in the plane of the ecliptic, and as the orbital velocity of the earth varies with different seasons, the time at which the sun really passes the meridian occurs sometimes before and sometimes after twelve o'clock at noon, with an irregularly increasing or decreasing variation, the greatest difference between the true solar time and mean time being about 16 minutes and 45 seconds.

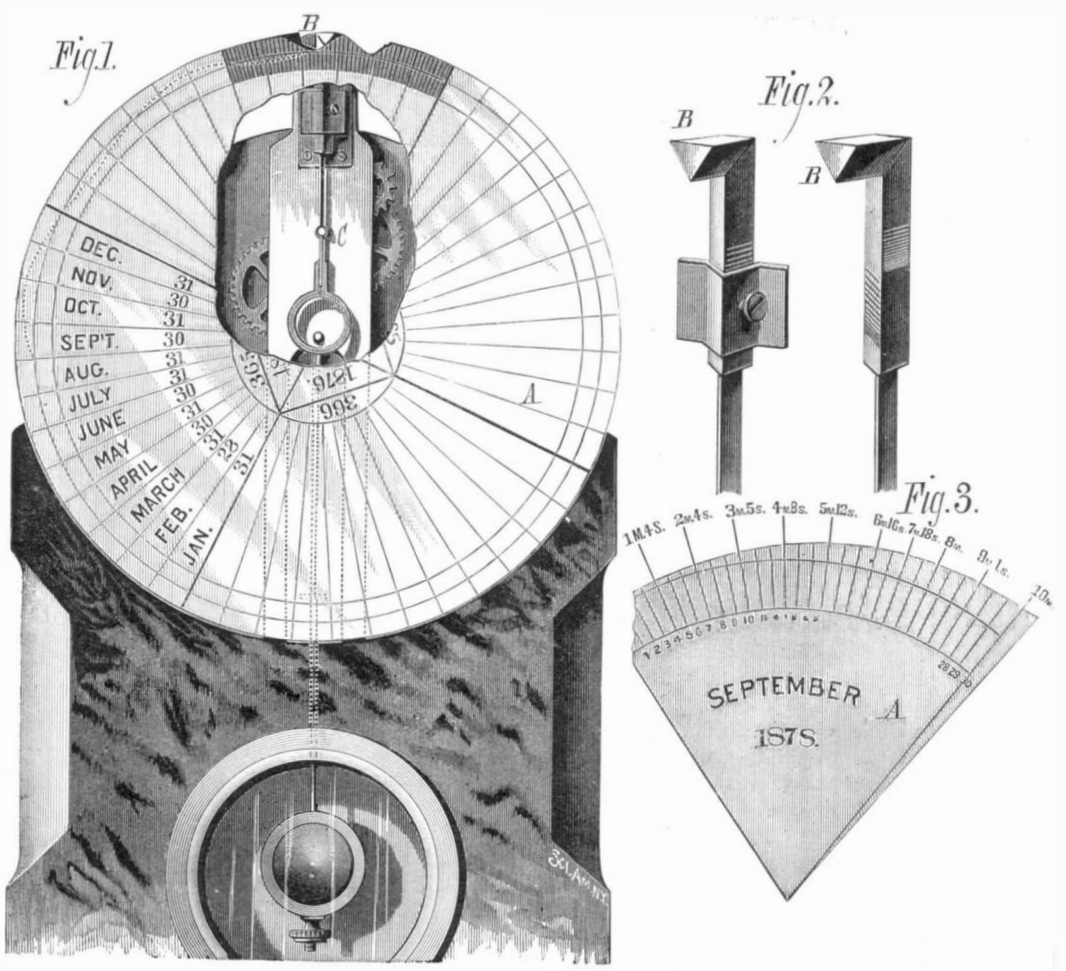
It is impossible to indicate the true time by means of an ordinary clock, as it must be automatically regulated to run faster or slower, according to the diurnal difference between mean and true time.

The velocity of a clock being proportionate to the number of oscillations of the pendulum in a given time, and these being dependent on the length of the pendulum, it is obvious that the regulation of the clock may be accomplished by automatically changing the length of the pendulum of an accurate mean time clock according to the equation of time.

The accompanying engraving represents a simple and ingenious device for effecting the required change in the length of the pendulum. It is the invention of Francisco José Martins, of the city of Para, Brazil. Fig. 1 is a rear view of a clock having the improvement applied. Fig. 2 represents the pendulum slide in detail, and Fig. 3 represents a section of the graduated disk.

The rear view, Fig. 1, of a clock of the usual construction, excepting that it has a disk, A, at the back, which is connected with the train, so that it is rotated once in four years. This disk has formed on its edge a series of cams which engage the slide, B, to which the pendulum spring is attached. The cams on the periphery of the disk, A, are so proportioned as to raise or lower the pendulum the proper distance, and thus change its length for every moment of time, and the disk is divided into four year spaces, so as to include leap year, months, and days. The pendulum spring slides through a bifurcated stud, C, as it is raised or lowered by the action of the disk to compensate for the difference between mean and true time, and cause the clock to keep true time. It is believed by the inventor that this improvement will effect an entire revolution in clocks.

For further particulars concerning the invention address the inventor, P. O. Box 4,775, New York city.



MARTINS' TRUE TIME REGULATOR.

A Milk Test.

It is difficult to find milk in this city pure enough to determine the experiment, but a German paper gives a very simple test for watered milk. A well polished knitting needle is dipped into a deep vessel of milk, and immediately withdrawn in an upright position. If the sample is pure, some of the fluid will hang to the needle; but if water has been added to the milk, even in small proportions, the fluid will not adhere to the needle.

The Want of a Sewing Machine Motor.

The *Sewing Machine Journal* says that a practical motor for driving sewing machines is the article most wanted. Not a week passes, says the editor, that we do not have one or more inquiries for a motive power that can be applied to the family sewing machine. The last we had was from St. Petersburg, Russia, while about the same time came the inquiry from Mexico. We have heard of some motors that promised wonders; but they have died out, and are forgotten. Then there is the water motor, electricity, and steam—in a small way—all of which have their objections.

To be practicable, it must be a part and parcel of the machine, and easily managed. Another desideratum is its price. It should not be so extravagant that it costs more than the sewing machine, else it will not become popular, even though fitting the requirements of the user.

New Mechanical Inventions.

Mr. Oliver S. Presbrey, of Port Henry, N. Y., is the inventor of an improved Apparatus which may be used for Hoisting Purposes in various situations, but is more particularly intended for use in mines and quarries, and in other situations where a number of drums are employed at the same time and for the same kind of work.

Mr. Thomas Camp, of Covington, Ga., has patented an improved Cotton Condenser, in which perforated rotating cylinders and suction fans are employed for removing dirt and other foreign substances from cotton as it is delivered from the gin; and rolls are combined with the cylinders for the purpose of condensing or compressing the fibers of the cotton, and thereby forming it into a continuous sheet or wad of nearly uniform thickness.

An improved Wrench has been patented by Mr. August Beck, of New York city. This invention consists in a split ring or friction strap, having at one side of the split an arm that is pivoted in a lever handle, and having at the other side of the split an inclined plane, which is acted on by a pin in a short double arm that projects from the lever handle. The split ring is fitted to any object which it is desired to turn, such as a drill stock, or a bushing adapted to the heads and nuts of bolts. A forward movement of the hand lever brings the pin into engagement with the inclined plane, and thus contracts the ring, when a further forward movement results in turning the object to which the split ring is fitted.

Mr. John S. Birch, of Orange, N. J., has patented an improved Wrench, which is simple and convenient. The jaws adjust themselves to the object to be turned, and are not liable to slip off. It will hold a nut after it has been screwed off, and it has several other points of advantage.

An improved Faucet has been patented by Mr. Eugene Duchamp, of St. Martinville, La. The invention consists in a cylindrical pipe having a valve seat and side nozzle, and through its side an inclined slot sided by a stop flange, in combination with a cylindrical slide valve having a handle projecting through the said slot, said handle being surrounded by an oval sliding and turning sleeve, which serves as a bolt to lock it against the said stop flange.

An improved Saw Sharpener has been patented by Mr. T. H. McCray, of Evansville, Ind. This is an improvement in the class of saw sharpening and gumming machines in which a small emery wheel is mounted adjustably upon a standard adapted to be clamped to the saw frame.

Mr. James M. Fate, of Webster City, Iowa, has patented an improved Bucket Pump that may be worked effectively with slow motion without any loss of power or leaking. It consists of a revolving reel, an endless chain made of connected and pivoted buckets, and a trough extending crosswise in the reel below the center of the same, for taking up and conducting off the water.

An improvement in Hoes has been patented by Mr. Joseph N. Parker, of Vineland, N. J. The object of this invention is to improve the common field and garden hoe so that, with little additional expense, its practical utility and value may be doubled without interfering in the least with the common working of the hoe. By a small addition to the hoe it may be used as a scraper, rake, or cutter for pulling out all large or fine weeds by the roots, or for cutting the weeds on the principle of a mowing machine knife, or sickle.

Recent Inventions.

An improvement in Photo-Mechanical Printing has been patented by Mr. Johann Baptist Obernetter, of Munich, Bavaria. This invention has reference to an improvement in the art or process of preparing photographic plates for printing by mechanical means with common lithographic inks and presses, so that transparent or non-transparent plates may be employed, and in the prints the half tones

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brought out so as to give them the appearance of the common photographic albumen prints. The process is adapted to the practical requirements of photographers, as any number of photographs may be printed from the plate cheaply and rapidly, and in colors of absolute permanency.

Messrs. Edgar M. Luckett and Nelson Belanger, of Terrace, Utah Ter., have patented an improved Mode and Device for Packing Valve Stems, whereby the use of glands, bushing ring, and hemp packing is obviated and friction reduced, while the valve stem is exposed to no wear in the stuffing box.

Influence of Gaslight on the Eye.

The German Minister of Instruction, in a recent report on the influence of gaslight on the eye, concludes that no evil results follow a moderate use of gas, if the direct action of the yellow flame on the eye is prevented. Grave objections he makes to the use of zinc or lead shades, most evils affecting the eye being traceable to them. Their use, it is said, inevitably tends to blindness or inflammation, and other harmful effects. The milky white glass shade is the best, as it distributes the light and has a grateful effect on the eye. The burner should not be too close to the head, as congestions of the forehead and headaches result from the radiated heat. The glass plate below the gas is especially useful for the purpose, as it causes an equal distribution of the light—necessary where a number are working at one burner—prevents the radiation of heat, and tends to a steady illumination by shielding the flames from currents of air. In cases of highly inflamed eyes, he recommends dark blue globes.

A Mustard Congress.

The French are a famous nation for holding "congresses," as they term meetings for examining and discussing the merits of all sorts of discoveries and articles. Among the last announced at the Paris Exhibition is a congress to determine the merits of the mustards of various nations included in the Exhibition. This mustard congress is to consist of twelve gentlemen and twelve ladies, the suggestion having been made that men's palates are vitiated by smoking, and that women are likely to have a nicer appreciation of condiments. The trial is to be made on a large piece of boiled beef, followed by boiled pork, to be served to the twenty-four experts.

MR. FOWLER CROSSING THE CHANNEL.

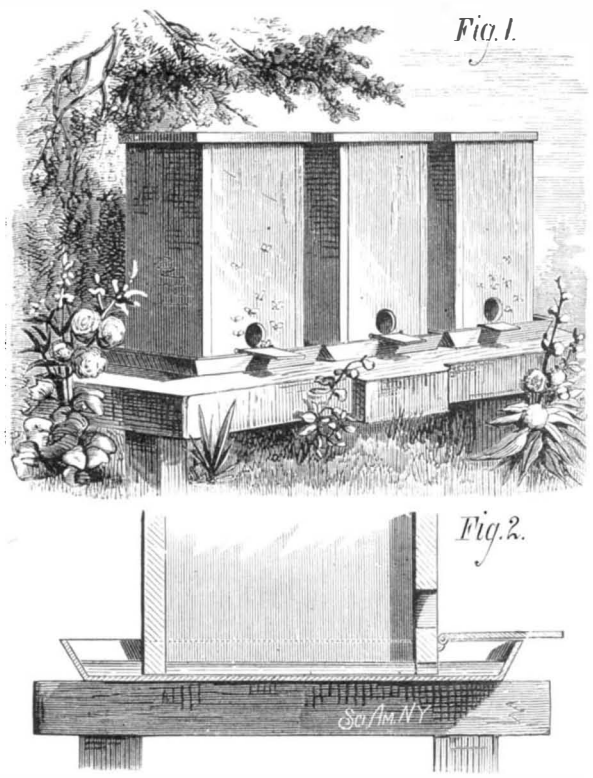
A curious project was recently carried out by Mr. Fowler, an American residing in Bordeaux. He crossed the Channel on a podoscaph, 6 meters in length. Each tube of this podoscaph, which is joined by rods, is 20 centimeters broad, and 30 centimeters high above the water. Leaving Boulogne at ¼ past 4 in the morning, he arrived at Sandgate at 3:35 in the afternoon. He experienced contrary wind and a heavy swell during a great part of the journey. The pilots and fishermen were surprised at seeing a man walking, as it were, on the water. The bold navigator was met with loud acclamations. He arrived at Folkestone somewhat fatigued. During the crossing, which lasted 12 hours, the only refreshment he took was a little coffee and a small piece of bread. The state of the sea prevented his stopping. The feat was accomplished to the satisfaction of everybody, and is a striking proof of energy and boldness. Mr. Fowler is Chevalier of the Legion of Honor, and owner of the yacht Peau-Rouge, which has gained several prizes in England and France. He was accompanied by the Petrel, belonging to an English captain.

The Durability of Submarine Telegraph Cables.

The expedition sent out to raise the submarine cable of 1866, like the one sent to raise that of 1865, failed to accomplish its mission. In the middle of last year, a new attempt was made, followed by more success, for two faults, one on the coast of Newfoundland and the other on the coast of Ireland, were then repaired. In consequence of this the Anglo-American Company and Telegraph Construction Company fitted out, at their joint expense, two vessels, which put to sea on the 25th of last May, for the purpose of finding and repairing the cable of 1866. The expedition has just returned to London. It reports having succeeded in grappling and raising the cable to the surface of the water fifteen different times, but the outer wires were so weakened by oxidation that it broke and was lost again in each case. The engineer in charge of the expedition therefore deemed the work of repair as entirely impracticable, and decided to return home. The unanimous opinion of electricians, says *L'Electricité*, is that the two first cables are defunct, and that ten years may be fixed as the average period that any cable will last which is not better protected against the corrosive action of the ocean. Fortunately the new cables are, as well known, better provided for in this respect.

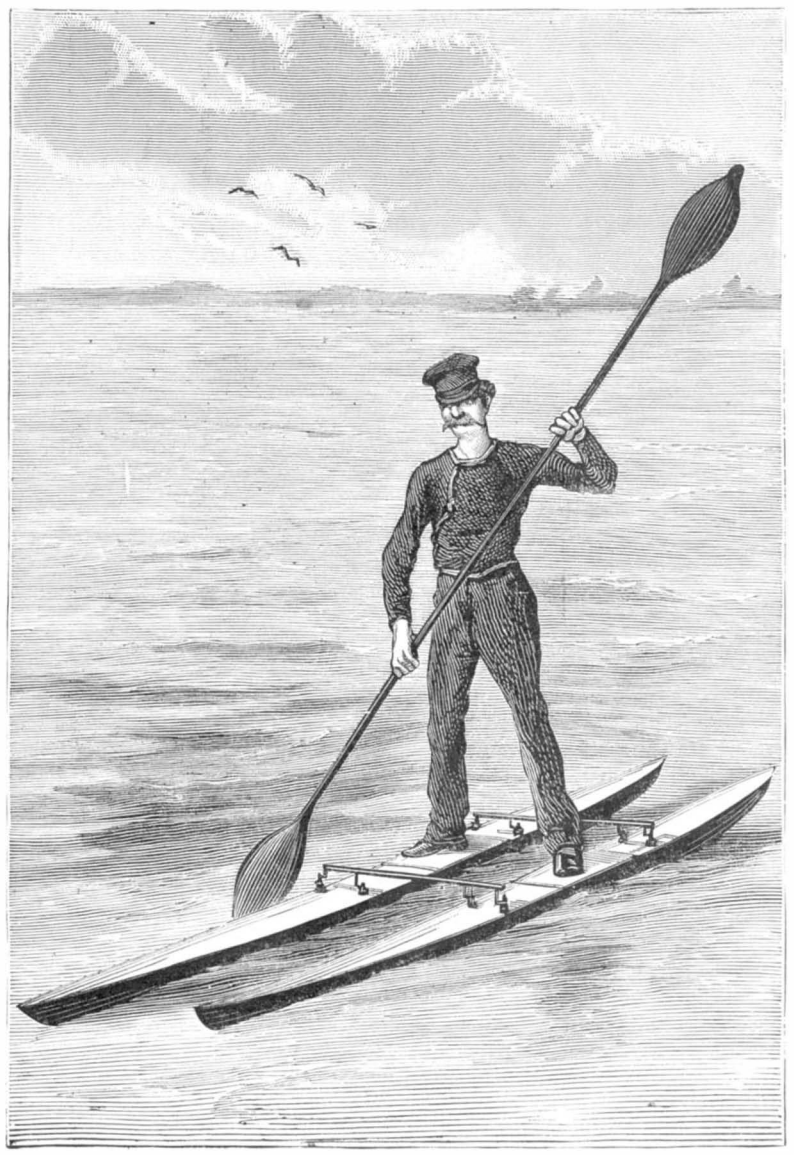
A NEW BEEHIVE.

The accompanying engraving represents a simple and effective device for protecting bees from the destructive moths which enter the hives and, depositing their eggs at the bottom of the hive or stand, gradually work upward under cover of their own webs until they reach the honeycomb and cause the bees to abandon the hive.



SPEARMAN'S BEEHIVE.

The hive or bee stand is placed in a shallow trough which is somewhat larger than the hive, and is partly filled with water. Below the hole through which the bees enter there is a small platform, which is hinged to the front of the hive so that it may be raised up to close the entrance, or let down upon the edge of the trough as a bridge over which the bees may pass to the entrance.



MR. FOWLER CROSSING THE CHANNEL.

Moths can enter the hive only through the entrance for bees, and those that enter will be drowned, and their eggs will be destroyed.

It is claimed that this device is an effective exterminator of the bee moth and protector of the bees, and that it is of great advantage to have the water near the hive, as bees in summer drink water in considerable quantities. For further particulars address the inventor, Mr. John R. Spearman, Silver street, Newberry county, S.C.

History of our Mining Laws in Brief.

A correspondent of the *Mining Record* says: I notice in the *Record* an inquiry by a reader, as to what is meant by a mine having a certain number of feet. The Consolidated Virginia owns 710, he says, and asks if these are square feet. They are linear feet, as mines are located and have been for many years. In early times in California, when rich quartz croppings were first discovered, the locations were confined to 50x100 feet, and some to 100 feet square.

Those were the times when persons could take rock from the croppings and pound it in a hand mortar, and get a great deal of gold; so it was supposed that 50x100 feet would furnish one man his share of gold contained in the country. It was soon ascertained, however, that this was not enough in deep quartz mining. A man was allowed to take up only one claim on a ledge. That law of the miners was evaded in this manner: a person finding a quartz ledge would mark off the number of feet to which he was entitled, 50x100 or 100 square feet, by putting a stake at each corner of the claim, with his name on a center stake; then staking out as many more claims as he wanted, he put the names of friends on the center stake of each. He then went to the Recorder of the district, after putting up his notice of location on the ledge, and had a copy of the notice and name of ledge, also names of locators, put on record. Next he went to the parties whose names he had used, and got bills of sales from them to himself of the claims located in their names. The parties would always sign the bills of sale without hesitation, or even inquire as to the locality of the location or richness of the rock, for they all did the same thing for each other. When it came to be understood that quartz ledges cropping above the surface with rich specimens in such abundance that a man could make a large amount of money in a short time, yet after they had been worked on for a time, and the cream was taken off, they became less productive, a change of the system of location was found necessary. Machinery had to be devised that could be driven by steam or water power to reduce the rock to a powder. Miners formed themselves into companies (unincorporated), and located ledges; then they made arrangements with persons having more money than muscle, or disposition to use what they had, to erect a mill with the appliances to run it and the amalgamating apparatus. The company of miners would put the mine in against the mill, so that each, the miners and person or persons erecting the reduction works, would receive one half of the profit made in the business. Persons would erect mills in the different quartz mining camps to do custom work, and charge so much per ton for working ore. The miner would receive the product, less the amount charged for working it. When the ore did not yield as much as the miners thought it ought, they accused the mill man of stealing the gold. Generally the miners would over value their ore, and of course were disappointed with the result.

A man owning a mill and doing custom work did not occupy a very enviable position. He was accused of stealing, whether falsely or not. Persons with means then began to purchase quartz ledges and form stock companies, and erect reduction works to work the ore. It soon became apparent that the mode adopted of taking up quartz claims would not do. Then the more liberal and reasonable plan was adopted of locating claims 100 feet in length on the ledge to each person locating, except that the discoverer was allowed to include 200 feet in his location. Afterward the miners became more liberal to themselves still, and made laws allowing 200 feet to a claim, the discoverer of the ledge to have 400 feet.

The law of Congress allows an individual or company to locate 1,500 linear feet on a quartz ledge, and 300 feet in width each side of the center of the ledge vein, or lode, with the dip, spurs and angles. That has been the mode of locating all ledge claims since the act was passed, and will continue to be until the law is changed, which is not likely to be done.

Preservation of Fruit.

A. Dal Piaz recommends to lay the fruit in a solution of sugar, mixed with salicylic acid. The proportions are 100—500 grammes sugar, 2½ to 3 grammes salicylic acid to 1 liter water. Cherries, raspberries, pears, grapes, etc., have been preserved in this manner for a year without losing their natural aroma.

WE intend in our next issue to publish an illustrated description of the new Wilson Sewing Machine which is soon to be placed upon the market. This machine possesses many points of novelty which will be of interest to our readers.

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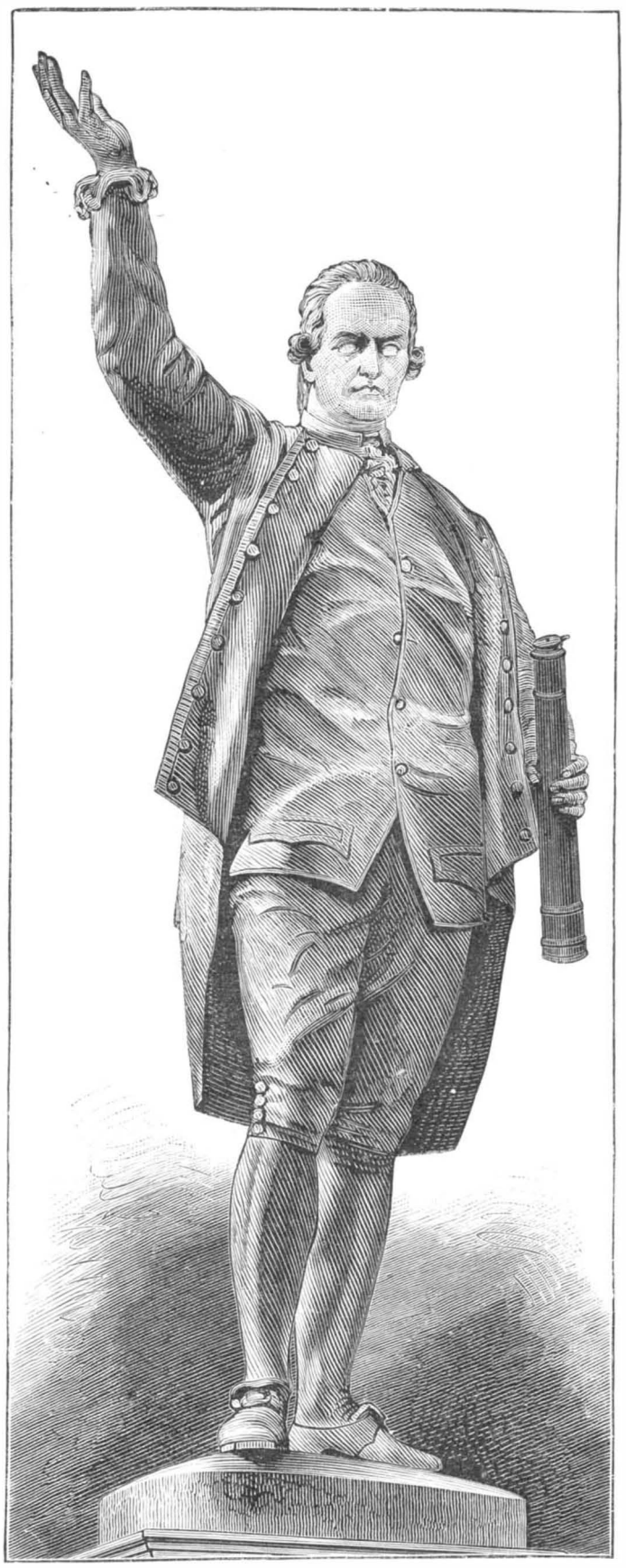
STATUE OF CAPTAIN COOK.

The committee who have made the arrangements for the bronze statue of Captain James Cook, the great navigator, which is to stand on a lofty pedestal, 22 feet in height, overlooking Sydney Harbor, have given their sanction to the statue being exhibited for two months in London before it is shipped for New South Wales, and the colossal figure has been accordingly placed on the same square of land, between the Athenæum and the Senior United Service Club, on which the late Mr. Foley's equestrian statue of Sir James Outram, now in Calcutta, was displayed for a time for the criticism and admiration of London. The custom of preliminary exhibition in London has many advantages, and might well be made general. Mr. Woolner, R. A., is the sculptor of the fine piece of statuary which is now to be seen at the foot of Waterloo Place. He has chosen the moment when the intrepid sailor has just sighted the land of New Holland, which he called New South Wales, and took possession of in the name of the King. As we know from the narrative of his famous voyages, this was at an early hour on the morning of the 19th of April, 1770—108 years ago. The founder of the Australian colonies is represented with his right hand thrown in the air in a gesture expressing exultation; his left hand holds the telescope with which he has just seen the dim loom of the land. He wears, of course, the naval costume of the last century, and there was no difficulty in procuring an accurate likeness of him to serve as the original of the manly and intelligent face, which in the statue is thrown back as the eyes seem to scan the horizon. The Royal Society struck a medal in commemoration of Captain Cook after his tragic death at Hawaii; there is a fine Wedgwood medallion of him extant by Flaxman, and Nathaniel Dance painted his portrait. It hangs not far from the relics of Nelson in the Painted Hall of Greenwich Hospital. The back of the figure will be scrutinized by those who are interested in the old naval pigtail, which was the head ornament of all the best known maritime heroes of English history. The monument is 14 feet in height. It is at present placed on a wooden pedestal 13 feet high, and the effect is, therefore, not quite the same as it will have on the much loftier pedestal for which it is destined at Sydney. It was the work of three years, and has been cast by Messrs. Cox & Sons, who have recently sent fine statues to Glasgow. The weight of the statue is about two tons. Mr. Woolner's hand is already known in the Southern hemisphere by his statue of J. R. Godley, the founder of the Canterbury settlement, which is placed in Christchurch, New Zealand. To have executed for Sydney the statue of Captain James Cook, which after thirty years' discussion the colony is at length on the point of possessing, is to have a surer title to immortality. We take our illustration from the London *News*.



BRONZE STATUE OF CAPTAIN COOK FOR SYDNEY, AUSTRALIA.

Temporary and Variable Stars.

Professor Bickerton, in a paper on this subject, read before the Canterbury Philosophical Institute, England, reasons thus: The existence of variable stars seems sufficient to prove the existence of gigantic feebly luminous or non-luminous bodies. The existence of variable stars seems sufficient to prove there are such bodies, and, as I have shown, all the hypotheses offered in explanation of temporary stars assume their existence. The high temperature and small relative light of celestial radiation points to the same conclusion, or to non-luminous gas. It might be asked, If there are dark bodies, why not stellar eclipses? I do not know if such have been observed; it would be wonderful if any had been, for they must be very rare, probably as rare as temporary stars, for although we have all the depths of space in which eclipses are possible, on the other hand, with temporary stars we have attraction bringing very distant bodies together. Further, the points of light of the fixed stars form but a small area in space; and, lastly, if eclipses occurred they would probably not be recorded, as small black patches of cloud so often obscure a portion of the sky that such an occurrence would scarcely attract attention. But why should there not be large dark bodies? Laplace's theory of universal nebulæ may be assumed to be against it; but did Laplace assume that it was contemporaneous? If not, then even that theory does not interfere. All our conceptions seem to agree more with a rhythmic cycle than with any definite beginning or end.

If we assume this hypothesis, then the period of dissipation of energy seems indefinitely projected into futurity; for all radiation falling on the matter in space must prevent its temperature from falling so low as without this radiation, and when at a subsequent date a collision occurs, this heat must exalt the final temperature, nor does it appear that we need look forward to a gigantic dead sun as the final condition of this universe, for doubtless our universe has its own proper motion in space, which may bring us into collision with other universes. This shows gravitation to be as competent to multiply worlds as to absorb them one into another. But, after all, our hypothesis only takes us a step further back in time, and our imaginations a step further forward into the future, thus removing further than ever from our conceptions every trace of a beginning or promise of an end.

Manufacture of Smyrna and Persian Carpets.

Turkish and Persian carpets have for centuries held a prominent position in the markets of the world on account of their durability and the exceeding beauty of design; and though Halifax and Kidderminster produce truly magnificent fabrics for the decoration of our floors, the Oriental carpets are still held by dealers as sumptuous beyond comparison. As far as the quality is concerned, we believe, says the *Textile Manufacturer*, imitation would not be difficult, for they are in reality only Axminster or velvet pile, *i. e.*, cut carpets; the beauty of the design and the blending of the colors are, however, a peculiarity of the Eastern nations, if we take as illustrations the Indian shawls and the Moorish decorations still existing on old buildings, such as the Alhambra, in Spain. These carpets are made in the East by very small manufacturers, if so we may call them; in fact, they are nothing but home made articles. After being bought up by dealers, they find their way to Europe through the hands of a few importers. As in the East they are mostly put on the floor in the middle of a large apartment, upon which the family may sit or recline, or are used for kneeling upon during prayer, there is no attempt made to fit them to any sized room; they are thus only squares or parallelograms of certain stated and customary sizes; and when used as a covering for the floor in this country are taken as near as possible to the size of the room, minus a bare margin, which is generally left along the walls, from the sheer impossibility to find a carpet the exact size of the apartment. This drawback of fitting has militated very much against their more general adoption, for in most of our houses the flooring boards are not of a nature to be left bare without greatly offending the fitness of things in æsthetics.

We have been led to these remarks by an article in the German *Polytechnic Gazette*, wherein it is stated that for some time past these Turkey and Persian carpets have been manufactured to a considerable extent by a firm in Silesia, and sold in Paris and in England as the real and genuine productions of the indolent Orientals, a description which with true German philosophy is considered justified because they are so like the real articles.

We learn that the first step in the manufacture of these counterfeits is the production of the design, which is drawn in the usual manner, and sometimes, in order to attain perfection and avoid mistakes, it is even a proceeding not unlike calling out Goliath to whip David. These designs are submitted to the buyer (for the carpets are all made to order), and the disposition of the colors or their shades modified to suit his ideas in art. When all the details of the order are given, the design is divided into sections, and each of these transferred on design paper by a number of specially trained young ladies—a work which is similar to the well known "Berlin wool work," only that in place of wool and canvas, paper ruled in squares and colors are used. The transference requires considerable skill so to bring out the intended forms in the angular lines of the little squares as to closely imitate the curved lines of the original design. The wool to be used is specially selected, and, in order to copy the Oriental mode as much as possible, it is spun in the establishment in one operation. The wool is usually kept in the gray; only colors in constant request, such as black, white, scarlet, blue, and green, can be kept in stock; all others are dyed on the premises as required for the orders in hand. This facilitates the selection of tints by the buyer, and is a great desideratum at the present time, when there is such a wide variety of neutral tints capable of producing the most happy combinations. The actual production of the carpets is a knotting, combined with the most primitive mode of weaving; but which in this case has also been imitated, in order to produce the "real article." The loom used differs principally from all other looms by the total absence of all provision for the production of any shed or pattern; there being no jacquard, dobby, treadles, or tappets, the pattern is simply formed by hand. All that the loom contains is a yarn beam and a cloth beam, both occasionally turned by a crank and handle, and a slay. There is no kind of contrivance for throwing the shuttle. The warp is generally of hempen cord, or, where desired, of woolen yarn, and is mounted in the loom in such a manner that from the breast beam toward the yarn beam it rises at an angle of 60 degrees. Each weaver has a width of about a yard to attend to, so that there are, according to the width of the carpet, from eight to ten maidens employed in the loom. Each girl has before her the section of the design she has to produce, and within easy reach a certain quantity of the woolen threads assorted according to their colors. Each little diamond of the pattern or design paper is represented by a knot consisting of two or more woolen threads, which encircle two warp ends, and whose open ends are turned toward the weaver, thus forming the face or pile of the carpet, which projects a quarter to half an inch. It is cut level by nippers, and the girls acquire such skill in cutting all the ends to one length, that the last process, namely, cropping by machinery, has only to remove slight irregularities. When a whole row of knots from one selvedge to the other has been inserted, they are beaten home by a special tool with a handle, and much in the form of a garden hoe, after which a weft thread is inserted; this is done by the simple expedient of the outer girl throwing the shuttle between the warp as far as it will go, when it is taken up by another girl, and passed on, until ultimately it makes its exit at the other selvedge. When a few rows of knots have been inserted in this manner, they are beaten up with the heavy slay, in order that they may not deviate from the straight line. By this procedure it is possible to give the carpet any desired shape to fit the room, which is a decided advantage over the Oriental carpets, the outline of which are always rectilinear.

The material for all the marketable varieties of these carpets, with the single variation of the warp, as above indicated, is always the same; the difference in quality is produced by the greater or shorter length of the pile, or the greater or less density or compactness in which the same is laid.

From the foregoing, it is evident the process of manufacture is a very simple one, although calling for a tolerable amount of manipulative expertness. The design and arrangement of the colors has so far been the chief difficulty, but has now, we are assured, been successfully overcome by the firm in question; there is, however, one point of great importance, namely, the production, which, notwithstanding the high price commanded by the carpets, can only be made profitable where labor is cheap. This not being the case in

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our country, it is hopeless to expect this interesting branch of the textile industry to be introduced among us in the way it is carried out by the German firm, who, we understand, are at present executing a larger order for the Italian Court, including carpets at £150 and £250 each.

Proofs of Progress.

Joseph Nimmo, Jr., Acting Chief of the Bureau of Statistics, has issued a special report on the foreign commerce of the United States, from which it appears that the total foreign commerce of the United States—imports and exports—during the year ending June 30, 1878, was larger than during any year prior to 1873. The exports of domestic merchandise from the United States, during the year ending June 30, 1878, were larger than during any previous year in the history of the country. From the year 1863 to the year 1873, the net imports of merchandise into the United States largely exceeded the value of the exports of domestic merchandise from the United States, the excess of imports ranging from $39,000,000 to $182,000,000. During the years ending June 30, 1876, 1877 and 1878, however, the exports of domestic merchandise from the United States greatly exceeded the net imports of merchandise into the United States, the excess of imports increasing rapidly from year to year.

The principal commodities showing an increase in the quantity exported are:

Articles.	1868.	1878.	Increase.
Agricultural Implements	$613,381	$2,575,198	$1,901,817
Living Animals	733,395	5,844,653	5,111,258
Bread and Breadstuffs	68,980,997	181,774,507	112,793,510
Coal	1,516,220	2,359,467	843,247
Copper and Brass, and Manufs. of	939,250	3,078,349	2,139,099
Cotton Manufactures	4,871,054	11,435,628	6,564,574
Fruits, all kinds	406,512	1,376,969	970,457
Iron, and Manufactures of	6,040,961	10,696,970	4,656,009
Steel, and Manufs. of, ex. Firearms	348,468	1,389,078	1,038,610
Leather, and Manufactures of	1,414,372	8,077,659	6,663,287
Oil Cake	2,913,448	5,095,163	2,181,715
Coal Oil and Petroleum	21,810,676	46,574,974	24,764,298
Provisions	30,278,253	123,549,986	93,271,733

What the Reaping Machine has Done.

An exchange says: "When the reaping machine—that *bête noir* of the tramp who sits in the shade and listens to the man who tells him that he ought to ride in his carriage—was introduced to the country in 1850, the number of farmers and agricultural laborers in the twelve States in which it is now chiefly used was 1,301,863, and in 1870, 2,641,830. The difference in wages was still greater. In 1850, farm hands were paid $8 a month, and harvest hands from 80 cents to $1.50 a day; while in 1870 the wages of the former were $30 a month, and of the latter from $2 to $3.50 a day. This year farmers willingly paid harvest hands from $1.50 to $2.50 per day, while the manufacture of reaping machines is giving employment to thousands of skilled workmen. The same remark is applicable to all kinds of machinery, the hands employed during the last twenty years having more than doubled, and the wages quadrupled, while the population increased only 67 per cent. Comment on such a change of things is superfluous."

American Locomotives for Australia.

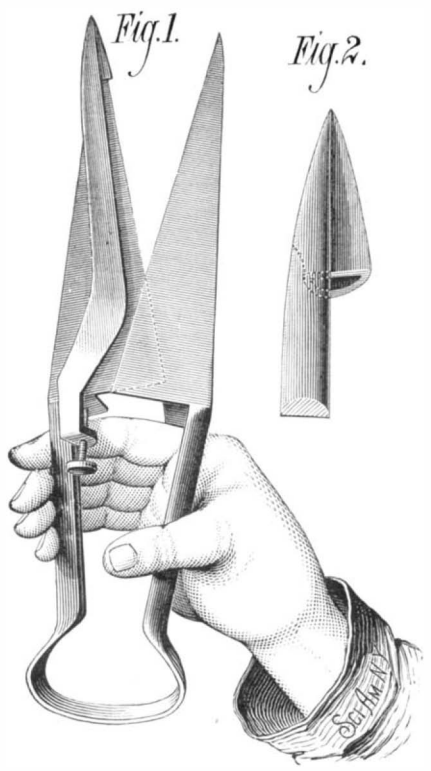
The Baldwin Locomotive Works, of Philadelphia, whose advertisement has for some time past been published in the SCIENTIFIC AMERICAN Export Edition, has lately shipped to Australia, by the clipper ship Colorado from this port, three powerful locomotives for Sydney, New South Wales, where they will be used on the railways owned by the Australian Government. The shipment comprises one passenger locomotive and two freight locomotives. The passenger locomotive has cylinders 18 inches by 24 inches, four driving wheels, 63 inches in diameter, and a four wheeled swinging bolster truck, with wheels 30 inches in diameter. The tender is on four wheeled trucks, in accordance with the usual American practice. All the truck wheels are steel tired. The two freight locomotives are of the "consolidation" type. These engines are of the largest and most powerful freight locomotives constructed. They weigh in working order, exclusive of tender, 102,000 pounds each. Their dimensions are: Cylinders, 20 inches by 24 inches; they have eight driving wheels, four feet in diameter. On one occasion, on the Susquehanna Division of the Northern Central Railway, where the grades are very light, one of these engines drew a train of 160 empty cars. The total length of the train was one mile. The usual work of engines on that division of the road is from ninety to one hundred loaded cars each trip.

American Electro-Plate in England.

On first appearances it seems somewhat strange that American manufacturers should be successfully competing with Sheffield houses in the manufacture of silver-plated goods. Yet really it should not be a matter for surprise, for in America there are some of the best workmen whom Sheffield ever sent across the Atlantic. This, of course a great advantage in itself, is heightened by the large employment of labor-saving machinery, and the result of the combination is that the American goods have a smarter and more perfect appearance than have those made here. That American electro-plate, however, should find a market in England is certainly somewhat singular; but such is the fact. We hear of one or two large export houses that are buying American plate almost exclusively, and who have well nigh discarded the goods of Sheffield houses. That the trade is developing is evident from the fact that American travelers in this line visit England three or four times a year, and that their pattern books are freely distributed.—*British Mercantile Gazette.*

NEW GUARD FOR SHEEP SHEARS.

With sheep shears of the ordinary form the experienced shearer is liable to cut the sheep in the operation of shearing, and in the hands of the unskilled the common shears are sure to work injury to the sheep.



HELMECKE'S GUARD FOR SHEEP SHEARS.

To facilitate the operation of shearing and to render it perfectly safe, Mr. Frederick A. Helmecke, of Round Top, Fayette Co., Texas, has devised the improvement shown in the accompanying engraving. It consists in a guard applied to one of the shear blades, and arranged nearly parallel with its cutting edge, and at such a distance from it that the opposite blade may readily pass into the space between the guard and the blade.

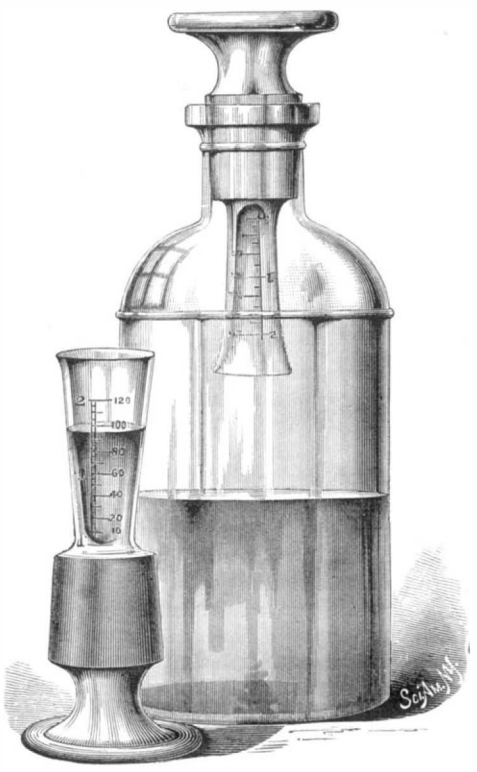
The guard has a socket for receiving the point of the shear blade, and a binding screw which engages the heel of the blade.

It is obvious that the blade thus protected cannot come into contact with the skin of the sheep. It will also be seen that when the guard is employed the shearing can be more closely and thoroughly done than without it.

For further information address the inventor as above.

NEW MEASURING STOPPER.

In the accompanying engraving is represented a little device, the invention of Mr. W. L. Keller, of Baltimore, Md., which must prove of great utility to druggists and chemists.



MEASURING STOPPER.

It will be readily understood from the cut. Upon the inner end of the stopper is formed a small graduated measure, which is similar to those commonly used. The stopper has a flat head that forms a stable base for the measuring glass. This invention obviates all loss of liquid, as it is returned to the bottle after the stopper is replaced. The glass need not be cleaned, as it is always used in the same liquid.

Labor in Massachusetts.

A few weeks ago Carroll D. Wright, Chief of the Massachusetts Bureau of Statistics, was called as a witness before the Congressional Labor Committee, and testified as fellows:

"In my official capacity I have given special attention to labor statistics, and am the author of the recent report which has been given to the public through the newspapers and otherwise. I have compared that report with the census of 1875, and find the two entirely in harmony. The number out of employment is about the same as in 1875, though the census of 1875 does not take into account the laboring men out of employment. In it there is a column of those never employed—persons of leisure. Both reports exclude those in almshouses; it may be that there are a few more now than in 1875; but the difference is very little. After the panic of 1873, there was an increase in the number of paupers all through the country; this has since been decreasing steadily; I have made very extensive inquiries throughout the United States, and have found no such condition of things as has been represented before this committee; I have no doubt the reports of destitution in the coal region are correct, but it is diminishing; I cannot tell the causes of this any more than I can tell how an apple grows; I have found as great difficulty in accounting for periods of prosperity as of suffering; I do not believe that the relief has come very greatly from the removal of the unemployed to other places; you cannot make a State prosperous by depopulating it."

Mr. Wright said that the shoe manufacturers of Massachusetts were enlarging their works, and the Amoskeag Print Works, at Worcester, N. H., was putting in 900 extra looms. Mr. Crompton, the loom manufacturer, had more orders than he could fill. The same improvement appeared in other States, and in all branches of trade, except the iron industry.

"Last year the work of laborers in Massachusetts on boots and shoes averaged eight hours a day; that of operatives in cotton mills from nine to ten hours a day; and that of carpenters and joiners about nine hours a day. Machinery does not take the place of labor; it calls for a higher class of labor. The wages of carpenters have increased from $1.75 in 1859 to $3.50 in 1868, and thence have fallen to $2 in 1878. The purchasing power of the wages is not quite so great now as it was in 1859. The wages and the moral, intellectual, and physical condition of the workingmen have been steadily improved during the last 100 years by the use of machinery. In Massachusetts it would require a population of 9,000,000 to do the work without machinery, which is now done with a population of 1,650,000; the accumulated property of the State would be used up by this extra population in less than two years, and the condition would then be worse than in China and India now."

Labor and Trade in Italy.

Mr. Charles McMillan, United States Consul-General at Rome, reports that in that part of Italy labor is in excess of demand. The wages of woolen, cotton, and silk spinners and weavers have not increased during the last 10 years. There has been a slight increase in the wages of masons, bricklayers, blacksmiths, and servants. Carpenters' and joiners' wages have increased 40 per cent.; tailors', shoemakers', and stonecutters', 20 per cent.; machinists', 15 per cent. A day's work is 10 hours, with half an hour for dinner in winter, and one and a half in summer. The advance in wages since 1873 is slight, and bears no proportion to the advance in the cost of living. When Rome became the capital of Italy, owing to the great influx of people, rents advanced from 75 to 100 per cent, where they still remain. Articles of food advanced in price 25 per cent, and have not yet sensibly decreased. Wages also increased at the same time—in some cases 40 per cent. The commerce of Italy has fallen off in imports and exports during the last five years, owing to the Eastern war, overstocked markets, and uncertainty as to the ratification of a commercial treaty with France. As regards Rome, there has been a slight improvement in its commerce and in its exports to the United States. Its principal articles of export are wool, cheese, hides of small animals, statuary, and other works of art. Manufactures of wool, cotton, silk, and leather are absorbed at home and in the neighborhood. The expenditures of the large number of visitors to Rome form a considerable part of its trade. The United States is now represented in Rome by 17 sculptors and 18 painters. The imports from the United States consist almost wholly of petroleum, cotton goods, sewing and agricultural machines.

MR. J. E. MONTGOMERY, United States Consul at Geneva, Switzerland, reports to the Department of State that he is constantly receiving letters from the United States upon the subject of introducing goods and products into Europe. He recommends generally, as the most effectual, if not the only method of increasing our trade with Europe, that manufacturers, producers, and others, should forward samples of their respective goods to responsible firms in the chief cities, with explicit statements as to the cost of importation of said goods to wholesale dealers in Europe.

THE rage for exhibitions has now spread even to Central Asia. The latest news from Tashkend states that an agricultural and industrial exhibition is about to be held there. Great preparations are being made for it at Samarcand, and the government has promised gold and silver medals to the exhibitors, as well as—honorary caftans!

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Natural History Notes.

Spontaneous Combustion of Wasps' Nests.—A correspondent of *Nature*, writing from Caracas, says that some time ago the dwelling of Gen. P. M. Arismendi (now Consul of Venezuela, in Port-of-Spain, Trinidad), in that city, had quite a narrow escape from being set on fire by the spontaneous combustion of the large paper-like nest of a wasp (a species of *Polistes*) in a closet under the roof. The day was exceedingly hot, but this was thought to have slight connection, if any, with the outbreak of smoke from the nest. In that country roofs are constructed of tiles supported by a thick layer of compact earth, which rests on the usual lath work of dry canes (stems of *Gynerium saccharoides*, or arborescent grass), both being bad conductors of heat. The source of heat must therefore have been in the nest itself. In beehives the temperature rises sometimes as high as 38° C. (*fide* Newport). It may be supposed that something similar occasionally happens also in wasps' nests. Such a heat might be caused by an alteration beginning in the wax, hydrocarbons being formed, which, on being absorbed by the paper-like porous substance of the cell walls, must become still more heated, so that a comparatively small access of oxygen would be sufficient to set the whole nest on fire. It has been asserted that the spontaneous combustion of wasps' nests is a well known occurrence in the interior of Venezuela, and it would be interesting to know whether a like fact has been observed in other parts of the world.

Inability of Birds to Distinguish Eggs.—A writer in the *Zoologist* states that this year he met with the nest of a blackbird, in which he found two misshapen three-cornered flints (evidently from the road), upon which, in addition to an egg laid that morning, the hen was complacently sitting. A week or two later he found the nest of a spotted flycatcher, containing three eggs, which he exchanged for hazelnuts, completely filling up the bottom of the nest. Upon returning a day or two later, he found one of the eggs ejected, and a fourth egg laid in its place; the bird was sitting when he approached it. Since birds evidently do not distinguish either stones or nuts from their eggs, it is easy to exchange the egg of one bird for that of another. A blackbird having built in a plum tree in the garden, and laid two eggs, the same observer having noticed that each evening she regularly left the nest at 7:45 P.M. for about a quarter of an hour, added an egg of the song thrush. She never noticed the addition, but sat on the three until the same time next evening, when, seeing that she had laid a third egg, he exchanged it for a second egg of a song thrush. This was repeated the next day, and had it not been for a cat, she would undoubtedly have laid her last egg, and reared an equal number of thrushes and blackbirds. Like experiments with the linnet and greenfinch were followed by the same results.

The Fruit of the Strawberry Shrub.—Mr. Thos. Meehan remarks (*Proceed. Phila. Acad. Sci.*) that though the sweet-scented or strawberry-scented shrub (*Calycanthus floridus*) has been under cultivation for many years, the fruit was very rarely seen. In correspondence with a leading author, it had been suggested that the plant might be incapable of self-fertilization, and that, being so far from its native place (Virginia and the Southern States), the special insect arranged to be the agent in fertilization had not followed it. Since that time Mr. Meehan had obtained seeds from the Cumberland Mountains, in Tennessee, and plants from these had flowered in his grounds, many of them producing fruit in the greatest abundance, while the old plants still remained as barren as they ever were. It was therefore clearly a case in which insects had no agency one way or the other. There was, he said, in plants two distinctive forms of force—the vegetative and the reproductive—the one growing out of and dependent on the other, and yet, to a certain extent, antagonistic; and that these forces had their lines especially in the petaloid and staminoid verticils, and this resulted in producing some individual plants abundantly productive of fruit, while others were almost or wholly barren. This was the case with most species of plants. The lines were never exactly drawn between these forces. In the case of the calycanthus, the earliest individual introduced to culture happened to be the one that favored the vegetative side, and in which the reproductive had but little power, and this individual, as often happens in nurseries, had been propagated from by cuttings or offsets and widely distributed. It was in this direction that we had to look for the explanation of many similar experiences, and not merely to the necessity for cross fertilization.

Notes on the Gall-making Plant Louse.—The life history and organic multiplication of the plant lice (*Aphidæ*) have always excited the interest of entomologists, and even of anatomists and embryologists. The life history, however, of the gall-making species belonging to the *Pemphiginæ* group has baffled the skill of observers more than that of any other. All of the older writers, in treating of the different gall-making *Pemphiginæ* of Europe, have invariably failed to trace the life history of the different species after the winged females leave the galls; and, with few exceptions, have erroneously inferred that the direct issue from the winged females hibernates somewhere. In a recent paper "On the Gall-making Plant Lice affecting the Elm," by Dr. Kessler, of Cassel, Germany, the author concludes, after a series of ingenious experiments, that the insect hibernates on the trunk, but he failed to discover in what condition they so hibernate. Professor C. V. Riley, led by his previous investigations into the habits of the grape *Phylloxera*, discovered in 1875 that some of our elm-feeding species of pemphiginæ produce wingless and mouthless males and females, and that the female lays but one solitary impregnated egg. Continuing his observations, especially this summer, he has been able to trace the life history of those species producing galls on our own elms, and to show that they all agree in this respect, and that the impregnated egg produced by the female is consigned to the sheltered portions of the trunk of the tree and there hibernates, the issue therefrom being the stem mother which founds the gall inhabiting colony the ensuing spring. Thus the analogy in the life history of the *Pemphiginæ* and *Phylloxerinæ* is established, and the question as to what becomes of the winged insects after they leave the gall is no longer an open one. They instinctively seek the bark of the tree, and there give birth to the sexual individuals, either directly or in one species, through intervening generations. These as yet unpublished facts were laid before the American Association in August, it being Professor Riley's intention to publish shortly some new biological discoveries relating to this family of insects, in connection with a descriptive and monographic paper by Mr. J. Monell, of the St. Louis Botanic Gardens.

The Ulikon, or Candle Fish, of Alaska.—The ulikon has long been an ichthyological curiosity, and has attracted the attention of every traveler who has visited the coast of British Columbia and Southern Alaska. It is a small silvery fish, averaging about fourteen inches long, and in general appearance resembles a smelt. They are the fattest of all known fishes, and afford a superior oil when tried out. Dried, they serve as torches, and when a light is required, it is only necessary to touch the tail to the fire, when they will burn with a bright light for some time. No description can give an adequate idea of their numbers when ascending the rivers from the sea. The water is literally alive with them, and appears to be boiling. These fisheries have not been utilized except by the natives. The most important of the native fisheries is on the Nasse river, near the southern boundary of Alaska. The spot is named "Kit-lak-a-laks," and a Catholic mission was situated there. Many tribes come to these fisheries, which begin about the 20th of March. The first fish caught is addressed as a chief, and many apologies are made to him by the Indians for the necessity which compels them to destroy his kindred for the supply of their own wants. A feast is given, with appropriate songs, speeches, and dances, in his honor, and after that the fishing proceeds. The fishes are caught in wicker baskets, and are dried or smoked as much as their oily nature will allow. The fishing lasts a fortnight or three weeks, and supplies many hundred aborigines with food for a considerable period. The ulikon is described by Girard under the name of *Thaleichthys Pacificus*.

Snake Incubation.—A remarkable characteristic of the anaconda is that, like the sea snakes (*Hydrophidæ*), it produces its young alive. We have long been accustomed to think that only vipers produce live young—and hence their name—and that all non-venomous snakes lay eggs. But snakes, at least those in captivity, are constantly doing what is not expected of them. Several important zoological facts have recently been established at the London Zoological Gardens, to the surprise of the naturalists of England. In 1862, the then but slightly known non-venomous snake *Coronella lævis* gave birth to a family of six live young ones in a cage in London; and several other harmless snakes in the London ophidarium have also afforded cause for surprise, not only in producing live young, but in manifesting a very decided care for them. Some New World species have furnished examples of this; for instance, the garter snake, chicken snake, and the yellow boa of Jamaica, the latter on several occasions, and sometimes at the same time producing eggs which proved bad. Mr. Philip H. Gosse had a boa which was with eggs. For a long time it manifested discomfort and restlessness, being savage and irritable, till at length it produced a family of young ones. Knowing it was the habit of this snake to incubate its eggs, Mr. Gosse was greatly surprised at the event; and the startling question occurred to him, When circumstances are unfavorable for the deposition of eggs, could a snake retain them until the young are hatched? Mr. Gosse's surmises have been confirmed by similar occurrences at the Zoological Gardens and by other writers, who, in the subsequent interval, have also given careful attention to the habits of ophidians, and have produced valuable scientific works on the subject. The fact is now well ascertained that not only *Chilobothrus*, but several other oviparous species may at pleasure be rendered viviparous by retarding the deposition when circumstances are unfavorable for them. In fact, we find that we must almost discard those old distinctions of "oviparous" and "ovoviparous," which German authors tell us are not founded on any other ground than a greater or less development of the fœtus in the egg at the time of laying; or on the nature of the exterior covering of the egg, which is thicker and leathery in those which take some time in hatching, and slighter and membranous in those which are hatched either before or on deposition.

American Jute.

From a circular by Mr. Samuel C. Brown, of Trenton, N. J., it would appear that jute is likely to take its place in this country as a new and valuable agricultural product.

Mr. Brown says that it grows spontaneously in New Jersey, and suggests that it be cultivated in those districts especially adapted to its growth. In stating the importance of jute as a factor in commercial products, Mr. Brown says:

"Jute is now chiefly produced in India, and in that country to the extent of 1,000,000,000 lbs. annually, and about 20,000,000 lbs. are imported every year into the United States. If we can make jute a domestic product, its uses can be vastly multiplied, and the East Indian Government is already apprehensive that our country will not only produce this fiber for its own consumption, but become exporters of it. It is believed that this can be done with the India seed, at least in the more southerly States. But we feel assured that there is a jute-producing plant, familiar to all of us, growing spontaneously in sections of New Jersey, if not throughout its breadth, and the object of this circular is to acquaint the agriculturists of the State with its existence and possible value.

"I have experimented this summer in my garden with the seed both of the India and American plants, and a stalk from the American seed grew six feet high. But the average, as it will be found in most sections, will probably be from two to four feet."

A Probable Cure for the Cotton Worm.

Early last summer the Entomological Commission, consisting of Professors C. V. Riley, A. R. Grote, and J. H. Comstock, began a study of the cotton worm which is likely to result in the easy extinction of the pest. The cotton plant is peculiar in having a gland on from one to three of the larger ribs of the more mature leaves, and a still larger gland at the base of each of the three lobes of the involucre. As soon as Professor Riley learned that these glands secreted a sweetened liquid he inferred that the plant would be found to furnish nourishment to the moth as well as to the larvæ, and drew attention to this belief in the *Atlanta Constitution*. Subsequently, in company with Professors Comstock and Willet, he was able to prove his anticipation correct by studying the normal habits of the moth with a dark lantern at night. The moth is attracted to the cotton plant by the sweets which the leaf affords; and as these sweets are first produced when the plant begins to flower and fruit, we have here a possible explanation of the well known fact that the worm is never noticed on the young plants, but first appears about the time of fruiting. It was also discovered that the cotton moth feeds on the honey secreted from glands occurring on the cow pea, extensively grown through the South as a forage plant.

By taking advantage of the moth's love of sweets Professor Riley believes that it will be no hard matter to prevent the ravages of the worm. He is now having experiments made to test the effects of different poisons, mixed with sweets, to use as bait. These baits may be applied to the trunks of the dead pine trees that occur in so many cotton plantations, or to the trunks of any other trees, or they may be used in pans upon which perforated platforms of wood or tin are made to float.

After the eggs are laid and the worms hatched the most effective cure is Paris green.

New Agricultural Inventions.

Mr. Armondos Frank, of Howell, Mich., has patented an improved Hay Fork that takes up the load of hay or grain with great facility, and retains the same during the time that the fork is traveling to the point where the load is to be deposited, the tines being then opened in convenient manner, and the fork returned to the place of charging.

Mr. Charles Van Houten, of Marion, Ohio, has patented an improved Grain Binder, which consists in the arrangement of the rake, which is carried by an extensible lever made in the form of the lazy tongs, and pivoted upon an independent horizontal fulcrum, so as to give the rake a compound movement, due partly to the extension and retraction of the same from the movement of the lazy tongs, and partly to the integral oscillation of the lazy tongs upon their outside pivots. It also consists in a peculiar slotted spool for twisting the two ends of wire around the sheaf, and its arrangement with respect to the devices for carrying the wire. The invention also has other features, which cannot be properly described without an engraving.

Mr. Daniel O. Fosgate, of Red Wing, Minn., has patented an improved Sulky Plow of light but durable construction, that may be easily controlled and operated by the driver. It consists of a plow frame that is supported on angular axles, and capable of adjustment for being leveled by means of a sliding and slotted axle and suitable mechanism operated from the driver's seat. The plow frame is made with a bend at the rear part for holding the plow firm and steady at any height.

Mr. William G. Reid, of Rock Hill, S. C., has patented an improved Plow. This invention relates to a means for adjusting the standard of a plow nearer to or further from a vertical line, in order to regulate the depth of the furrow.

Mr. Charles K. Conner, of Camp Point, Ill., has patented an improved Machine for Husking Corn from the stalks while standing in the field; it is simple, convenient, and effective, removing the ears from the stalks and husking them as it is drawn forward through the field, husking one row at a time.

An improvement in Oscillating Steam Valves has been patented by Mr. Charles J. Van Depoele, of Detroit, Mich. The object of this invention is to simplify the construction of the valves of steam engines, and to reduce the friction and wear to a minimum.

HYDROGEN gas, the lightest of all ponderable substances, may, when cooled to 220° Fah. below zero, be then condensed, by a pressure of 9,750 lbs. to the square inch, into liquid form. To produce this great reduction of temperature and enormous pressure in combination is a difficult experiment.

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TO INVENTORS.

An experience of more than thirty years, and the preparation of not less than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly, the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent complete—including the model—to the Patent Office the same day the papers are signed at our office, or received by mail, so there is no delay in filing the case a complaint we often hear from other sources. Another advantage to the inventor in securing his patent through the Scientific American Patent Agency, it insures a special notice of the invention in the SCIENTIFIC AMERICAN, which publication often opens negotiations for the sale of the patent or manufacture of the article. A synopsis of the patent laws in foreign countries may be found on another page, and persons contemplating the securing of patents abroad are invited to write to this office for prices, which have been reduced in accordance with the times, and our perfected facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

National Steam Pump is now on exhibition at the American Institute; also 46 Cortlandt St., N. Y.

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with a small capital. Also lanterns for college and home amusement. 74 page catalogue free. McAllister, Mf. Optician, 49 Nassau St., N.Y.

Vertical Engines, 10 to 15 H. P., thoroughly well made. John Hartrick & Co., 47 Gold street, New York.

Northrop's Sheet Iron Roofing makes most durable fireproof roof. Used on all kinds of buildings. Send for circular and prices. Northrop & Co., Pittsburgh, Pa.

Vertical & Yacht Engines. N.W.Twiss, New Haven, Ct.

"W.H.B."—Guy C. Hotchkiss, Field & Co., 622 East 14th street, New York, have a Hydraulic Sheet Punch for sale. Capacity 72 holes at one time; worked by direct-acting steam cylinder. Price $1,000.

Wanted.—Light Motor, 2 or 3 horse power, to propel Aerial Car. Gas or oil engine preferred. Address R. W. Cowan, P. O. Box 409, Montreal, Canada.

Engines, ½ to 5 H. P. Geo. F. Shedd, Waltham, Mass.

Wanted.—Low priced, second hand Lewis, Oliver & Phillips Bolt Header. G. C. Chase, Manchester, N. H.

Scroll Saw Designs. L. H. Russell, Stratford, Conn.

H. Prentiss & Co., 14 Dey St., N. Y., Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

Extension of time.—Proposals for Jacksonville Water Works will be received until November 21, 1878. See advertisement page 237, October 12, 1878.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

Right to manufacture a salable patented article desired by an old established house; would pay royalty or purchase. G. Thomas, Box 23, West Troy, N. Y.

Useful Books for Engineers and Mechanics. Catalogues free. E. & F. N. Spon, 446 Broome St., New York.

Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the SCIENTIFIC AMERICAN Export Edition. This paper has a very large foreign circulation.

The Lawrence Engine is the best. See ad. page 270.

For the most substantial Wood-Working Tools, address E. & F. Gleason, 52 Canal St., Philadelphia, Pa.

Warranted best and cheapest Planers, Jointers, Universal Woodworkers, Band and Scroll Saws, etc., manufactured by Bentel, Margedant & Co., Hamilton, Ohio.

Magneto Call Bells for Telephone Lines. The Best. No battery required. Bunnell, 112 Liberty St., N. Y.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

Eagle Anvils 9 cents per pound. Fully warranted.

Diamond Self-clamp Paper Cutter and Bookbinders' Machinery. Howard Iron Works, Buffalo, N. Y.

Notice.—Charles N. Elliott, of N. Y., is no longer connected officially with the Ingersoll Rock Drill Company and is not authorized to collect moneys or transact any business whatever for the same.

Kreider, Campbell & Co., 1030 Germantown Ave., Phila., Pa., contractors for mills for all kinds of grinding.

Alcott's Turbine received the Centennial Medal.

The only Engine in the market attached to boiler having cold bearings. F.F.& A.B.Landis, Lancaster, Pa.

Dead Pulleys, that stop the running of Loose Pulleys and Belts, taking the strain from Line Shaft when Machine is not in use. Taper Sleeve Pulley Works, Erie, Pa.

Pulverizing Mills for all hard substances and grinding purposes. Walker Bros. & Co., 23d and Wood St., Phila.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Wheelbarrows.—Over 50 styles, with felloe-plated, bolted wheels. Pugsley & Chapman, 8 Liberty St., N.Y.

North's Lathe Dog. 347 N. 4th St., Philadelphia, Pa.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J. English Agency, 18 Caroline St., Birmingham,

Boilers ready for shipment, new and 2d hand. For a good boiler, send to Hilles & Jones, Wilmington, Del.

Punching Presses, Drop Hammers, and Dies for working Metals, etc. The Stiles & Parker Press Co., Middletown, Conn.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn, N. Y., and Paris Exposition, 1878.

For Power & Economy, Alcott's Turbine, Mt. Holly, N.J.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See advertisement.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

NEW BOOKS AND PUBLICATIONS.

VICTORIAN RAILWAYS. Report of the Board of Land and Works, for the year ending December 31, 1877. Melbourne, Australia, 1878.

At the close of 1877 there were in the colony 931 miles of railway open for traffic, and 32 in course of completion. The construction of 161 miles more had been authorized by parliament. The average number of miles open for traffic the whole year was 787. The total train mileage was 3,420,960 miles; the number of passenger journeys, averaging 21⅞ miles, was 3,395,709. The average earnings per mile of road were $7,215; the average expenses, $3,765. The proportions of passenger and goods traffic to the total revenue were 40 and 60 per cent respectively. A colored map of the four railway systems of the colony, and illustrations of the different types of locomotives and carriages used, accompany the report.

ANNUAL REPORT OF THE DEPARTMENT OF MINES, New South Wales, for the year 1877. Sydney, Australia, 1878.

The mineral resources of New South Wales include gold, coal, tin, copper, iron, silver, lead, and antimony. The aggregate value of all the mining products of the colony, up to January, 1878, was nearly £46,440,000. The yield for 1877 was £2,233,161. The report contains valuable geological maps of the mineral districts. The minister of mines calls attention to the use of telephones in underground operations in this country; and expresses the hope that by the introduction of better mechanical appliances a fresh stimulus would be given to mining research, and mining operations would be carried on with greater expedition and economy.

INDUSTRIAL SCIENCE DRAWING: Elements of Free-Hand Geometrical Drawing. By S. Edward Warren, C.E. New York: John Wiley & Sons, 1878. Price $1.

Though nominally a second edition, this is substantially a new work. Part I. treats of plane drawing; Part II., on drawing from "the round," is largely new; and Part III., on the elements of geometric beauty, is almost wholly new.

FERNS IN THEIR HOMES AND OURS. With 8 ch rom-lithographs of rare ferns. By John Robinson. Salem, Mass.: S. E. Cassino. 12mo. Price $1.50.

In this attractive little book Professor Robinson has described the growth, structure, and distribution of ferns, and their cultivation under glass, in ferneries, and out of doors. Dr. A. S. Packard furnishes 10 illustrations for a chapter on fern pests and means for their destruction.

A MANUAL OF THE MECHANICS OF ENGINEERING AND OF THE CONSTRUCTION OF MACHINES. By Dr. Phil. Julius Wiesbach. Second volume. Part II. Translated by A. Jay Du Bois, Ph.D., with additions by R. H. Buel, C.E. New York: John Wiley & Sons, 1878.

This, the second half of the second volume of Wiesbach's mechanics, is devoted to heat, steam, and steam engines. The character of Dr. Wiesbach's work is too well known to require comment here. Mr. Buel has undertaken to supply any deficiencies with regard to American steam engineering.

ELECTRIC LIGHTING. A Practical Treatise by Hippolyte Fontaine. Translated from the French by Dr. Paget Higgs, Assoc. Inst. C.E. With 48 illustrations. 8vo. pp. 194. $3. E. & F. N. Spon, N. Y.

This work is designed to show what are, in the present state of science, the judicious applications of electric lighting, to record the services that this new light is capable of rendering to a multitude of industries, and to combat false ideas founded on the possibility of its universal use.

Notes & Queries

(1) T. F. V. asks: What is best for drinking water to run through, black, galvanized or lead pipe? A. Lead and galvanized iron pipes should not be used as conduits for drinking water. The black enameled pipe answers very well, but in many cases wood tubes are preferable where they can be employed.

(2) Reader asks: Can you give a method of making champagne cider? A. Good pale vinous cider, 1 hogshead; proof spirit, 3 gallons; honey or sugar, 14 lbs.; mix, and let them remain together in a temperate situation for a month; then add one quart of orange flower water, and fine it down with ½ gallon of skimmed milk.

(3) "Scientific" asks: How can I melt rubber gum (as it comes from the rubber boot factory) so as to run into a mould such as is used in casting printers' rollers? A. Vulcanized rubber cannot be melted in the way you propose, as it suffers partial decomposition in the operation, and does not again assume its original qualities on cooling.

(4) E. S. F. asks: What is the intrinsic value of gold? A. Coin value: 24 carats fine = pure gold. 1 grain = 4⅘ cents. 23$\frac{11}{20}$ grains = $1. 1 dwt. = $1.03½. 1 ounce (troy) = $20.67.

(5) M. S. asks: What is the proper composition for 18 carat gold? A. 18 dwts. fine gold, 2¾ dwts. fine silver, 3¼ dwts. copper. Or fine gold 100 dwts., fine silver 19$\frac{2}{3}$ dwts., copper 13⅓ dwts. For red 18 carat ring gold the following proportions are used: fine gold 40 dwts., silver 4½ dwts., copper 8$\frac{2}{3}$ dwts.

(6) A. B. asks (1) for the ingredients and manner of mixing and making crucibles. A. There are in common use two methods of making crucibles, one by forcibly shaping the moist ingredients in a double mould; the other by pouring the "slip," of the consistence of cream, into porous moulds of a species of stucco. In the latter case a series of the moulds are placed upon a table and filled with the semi-fluid composition. By the time this operation is finished on 50 or 60 moulds the workman returns to the filled, and alternately pours the slip out of them, leaving only a small quantity sufficient to give the requisite thickness to the bottom. In each of the moulds so filled a perfect crucible is formed by the abstraction of the water of that portion of the "slip" in immediate contact with the stucco, and the crucible will be either thicker or thinner in proportion to the time this absorbent action has been allowed to go on. 70 or 80 crucibles may thus be formed in 15 minutes. The moulds and their contents are placed in a slow oven. In a short time from the contraction of the clay in drying the crucibles may be removed and the moulds dried thoroughly and used again. As soon as the crucibles, formed by either of the above methods, have become perfectly dry they are baked by subjecting them to the heat of a potter's kiln. The composition of which crucibles are made differs according to the uses for which they are intended. The following may be taken as good specimens—(German), Stourbridge clay, 8 parts; cement (old crucibles ground to fine powder), 3 parts; coke, 5 parts; graphite, 4 parts. Or Stourbridge clay, 4 parts; cement, 2 parts; coke powder and pipe clay, of each 1 part. Suitable for brass founders. (Hessian)—Clay (containing about 10 per cent of silica), about 75 percent; sand (containing a little alumina and lime), 25 per cent. (Black lead)—Fine refractory clay, 1 part; graphite, 2 to 3 parts; a little sand is often added. French clay crucibles are made of Paris clay with a small quantity of very fine sand. 2. Also tell me, is black lead and plumbago the same thing? A. Yes.

(7) T. A. Y.—You can get a patent on your article if it is new. You might also patent the machine for producing it.

(8) C. W. G. writes: I want to get two or three practical books on yacht building. I cannot find any that suits me. I have those you published in the SUPPLEMENT by Paddlefast, but I want something more complete with numerous plans. A. We believe the instructions in the SUPPLEMENT are the only practical work of the kind published.

Is iron when galvanized dipped in melted zinc? A. Yes.

(9) F. L. A. asks: 1. What preparation is used in drawing on zinc plates, so that when acid is applied it will eat everything from the surface except drawing? What acid is employed, and how? A. Coat the zinc, while warm, with an even film of wax or a varnish of wax and asphaltum, and after scratching the design through the coating with a suitable tool, place a rim of wax, or a putty of wax and pitch, around the edges, and cover the plate, while in a horizontal position, with dilute nitric acid. See p. 219 (37), vol. 34, SCIENTIFIC AMERICAN. 2. Will any other plate answer as well as zinc to electrotype from? A. No. 3. How is the acid removed after it has eaten to a sufficient depth? A. By washing with water.

(10) H. M. H. asks whether strychnine is used to make the thick foam (or thin) on beer or other malted liquors. A. The poisonous alkaloid is never used, to our knowledge, in beer or other liquor. The only effect it would have on beer would be to increase its bitter taste.

(11) W. J. S. asks: How can paper be prepared so that the action of the atmosphere will change it to several different colors in such a manner that it can be used, like a barometer, for foretelling the weather? A. Saturate the paper with a moderately concentrated aqueous solution of cobalt chloride; press and dry. When properly prepared dry air develops a blue color and moist air a pink tint. The arrangement does not foretell the weather, but simply indicates the hygroscopic condition of the surrounding air.

How can ink powders be made so that by the addition of cold water they will produce first class black, red, green, blue, and violet ink? A. See p. 315 (15), vol. 38, SCIENTIFIC AMERICAN. Soluble nigrosine (in 200 parts of water) also makes a good bluish-black ink. For red use "rubine extra" (dissolves in 150 parts of water); for violet, methyl-violet 5B, or BR, Hofmann's violet 3B, gentiana-violet B (dissolve in 300 parts of water for use); for blue, water blue BR, 5B, or 2B (dissolve in 200 parts water); for green, methyl-green (dissolves in 100 parts water). These latter are aniline colors, and the inks require no gum.

Can you give a description of the geometrical lathe, or refer to some work that does describe it? A. "The Lathe and its Uses."

(12) C. D. H.—In SUPPLEMENTS 30 and 32 complete directions for building a small rowboat were given, which were not repeated in succeeding numbers. Those who wish to follow the instructions for building the family boat, the Whitehall boat, the canoe or the yacht, should first read the initial directions in SUPPLEMENTS 30 and 32.

(13) W. F. asks: Have the actions of the gyroscope ever been explained, and if so, what is the explanation? Why does the north pole always point to the same place in the heavens? A. It is due to the persistency of a rotating body in maintaining its plane of rotation against the force of gravitation.

(14) H. G. writes: I have been casting small wheels out of zinc in a brass mould. I have poured the metal at different temperatures, but there are always cracks in the outer ring of the wheel. What is the trouble? A. The zinc contracts in cooling, and as the mould is rigid it must of necessity crack. Use a sand mould or employ a tougher metal.

(15) B. B. S. writes: I have a small sailboat, 15 feet by 3 feet. Please let me know the largest amount of sail that I can carry. A. The size of small boat sails is determined only by custom and experience. If your boat is stiff for its width it will carry a sprit sail 6½ feet on the mast and 8½ feet on the boom.

(16) R. W. M. writes: A shaft 60 feet long, 40 feet of which is 3 inches in diameter, and the remaining 20 feet only 2½ inches in diameter, has been thrown out of line by unequal settlement of building. Can it be lined up true without being taken out of boxes to have the boxes lined up? A. This is quite possible if the amount of spring is not excessive.

(17) R. C. K.—A thermometer will indicate a lower temperature in the wind than out of it.

(18) O. E. D. asks: How much power is lost in using the common treadle and crank motion? A. None, as we understand your meaning, if the mechanism is properly constructed. In practice, however, there is usually a considerable loss on account of friction or from other causes.

(19) A. J. asks for the best and cheapest process of manufacturing vinegar from wine and cider, and which is best and cheapest made, wine or cider vinegar. A. See pp 284 (50), and 86, vol. 37, and 122 (6), 218 (4), and 171 (47), vol. 34, SCIENTIFIC AMERICAN. Consult Dussauce's "Treatise on the Manufacture of Vinegar." Wine vinegar is generally considered the best.

(20) X. asks: 1. How to construct a cheap and efficient "call" for the telephone described on p. 75, SCIENTIFIC AMERICAN, No. 5, current volume? A. Connect a small bell that will jingle easily, with the telephone cord, by means of a short piece of thread, which should be slack when the telephone is used. 2. The telephones are separated by a distance of 5 blocks, and it works splendid, except when the wind blows. The wind produces a humming noise in the telephones which can be heard all over the room. What will prevent this? A. We do not know of a way to prevent the noise.

(21) C.—You will find a good article on the subject of testing oils in Normandy's "Commercial Analysis."

(22) P. A. F. writes: I desire to know if during an epidemic of diphtheria, scarlet fever, whooping cough, or any other contagious disease to which children are subject, any injury will be done or benefit be obtained by keeping a teaspoonful of carbolic acid on a plate in sleeping rooms and all other rooms in the house? Will the acid in a crystal or diluted state be best to use? I often see it recommended to be used in time of epidemics, but they never tell how to use it. A. Carbolic acid is often used in this way. The odor of the substance is not pleasant, otherwise no bad effect need be apprehended. The acid need not be diluted. In cases of contagious diseases the disinfectant is usually mixed with about 20 parts of water and sprayed over the carpets, linen, and other fabrics in the infected apartments.

(23) P. R.—We do not understand your queries.

(24) S. H. C.—Energy of water in foot lbs.

$$= \frac{\left(\begin{smallmatrix}\text{pounds discharged}\\ \text{per second}\end{smallmatrix}\right) \times \left(\begin{smallmatrix}\text{velocity of discharge}\\ \text{in feet per second}\end{smallmatrix}\right)^2}{64{\cdot}4.}$$

(25) X. Y. Z. asks for a recipe for modeling wax, such as is used by modelers of small fine figures. A. Lead plaster, 8 ozs.; beeswax, 8 ozs.; Burgundy pitch, 8 ozs. Melt together and stir in sufficient prepared chalk to form a paste. Mould it in small sticks for use.

(26) C. V. writes: I have a number of good wine casks that have become musty. I have tried to sweeten them by washing and steaming, but have failed to get them in a condition to put wine in. A. Burn a little sulphur in the empty casks, bung, and let them stand for a day.

(27) W. W. R. asks how to make a good white ink to write on black paper or cardboard. A. Try finely ground (or freshly precipitated) barium sulphate or "flake white" mixed with a little gum water.

Where can I obtain stone bottles varying in size from one gill to one pint in size? A. These sizes are seldom met with in stores: they are made to order.

(28) J. M. G. writes: I have a problem to propose for solution which has puzzled me. It is this: suppose a quart bottle of powder, sealed and sunk into the sea, say 3 miles deep, or at such a depth that the pressure all round is greater than the explosive force of the powder, fired by a wire and galvanic battery. Will the glass be broken, or the bottle hold the gas of the exploded powder, or the powder burn without any explosion? A. If such conditions could be realized there would be no explosion. The powder would burn, and the products of its combustion would remain in the bottle.

(29) J. G. S. writes: I send two balls taken out of the piston head of my engine; there were quite a number of them. I would like to know how they were formed and of what. I use pure tallow or beeswax as a lubricant for my cylinder. A. The balls consist principally of metallic iron (dust) and partially charred or decomposed wax. They are formed by the friction of the head under imperfect lubrication.

(30) F. S. B.—To correct spherical aberration in your speculum use a small polishing tool charged with a paste of putty powder, and work carefully from the periphery inward, testing the speculum occasionally.

(31) "A Reader" asks: 1. What is meant by steam being cut off at the stroke of a steam engine? For instance: assuming the stroke to a steam engine to be 4 feet, cut off at ½ of the stroke, how many feet will the piston be driven, by expansion only, during the completion of one revolution of the engine? A. Two feet. 2. Please give the horse power, and the rule for working it, of a steam engine of the following dimensions: Diameter of cylinder, 10 inches; length of stroke 4 feet, cut off at ½ of the stroke, revolutions 45 per minute, pressure per steam gauge, 60 lbs. And

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also of the same without the cut off. A. To find the horse power, the mean pressure during the stroke must be known, and this can only be determined by experiment.

What does squaring the circle mean in a mathematical sense? A. Finding a square whose area shall equal that of the circle.

(32) J. R. D. asks: 1. Should a launch be built, 26 feet by 5 feet, with lines moulded after the Flirt (SCIENTIFIC AMERICAN SUPPLEMENT No. 31), what should be the increased dimensions of the boiler, engine, screw, etc., to speed 10 or 12 miles easily per hour? A. Make everything to scale throughout. 2. About what difference in cost of boiler between steel or iron, the latter to sustain a safe working pressure of 200 lbs. per square inch, the former $\frac{5}{16}$ inch thick? A. Probably not more than 20 per cent 3. What is the most suitable wood material in all respects for such boat building? Is not red cedar, and will it conform well when steamed? A. The most suitable wood for small boats is common cedar, with oak or hackmatack frame.

(33) W. L.—To harden magnets heat them to a dark cherry red, plunge them in cool water, then draw to a straw color. You will find methods of magnetizing given in No. 142 of SCIENTIFIC AMERICAN SUPPLEMENT in "How to make a Working Telephone."

(34) C. T. A. asks: 1. What is the expansive bulk of mercury per degree of heat in an open vessel? A. The rate of expansion varies with the temperature. Between 32° and 212° Fah. 1,000,000 parts of mercury become 1,018,153. 2. What is the expansive bulk of mercury per degree of heat under a vacuum? A. The same as in an open vessel. 3. If a bottle is half filled with mercury and half air, a glass tube, open at both ends, inserted through the cork and descending into the mercury, will the mercury rise higher than if the bottle was filled to the cork? A. Yes. 4. Would the difference in those proportions vary the rise of mercury in the tube? A. Yes. 5. If air is used in combination with mercury, will the elasticity of the air render the rise of the mercury in the column unreliable for thermometers? A. Yes.

(35) W. H.—Consult an advanced treatise on algebra.

(36) A "music teacher" writes: Do you know of any device that will do away with pen and ink to copy notes (in music) from the original, do it cheap, and at the same time enable anybody to use it? A. We think a series of rubber stamps would facilitate the operation.

(37) J. M. W. writes: I am building a small steam engine (horizontal), 3 inches bore and 5 inches stroke, to run 300 revolutions per minute, with from 50 to 90 lbs. of steam, cutting off at ¾ stroke. Will steam ways 1 inch by ½ inch be large enough? Exhaust 1 inch x 1 inch, bridges ½ inch, steam pipe ½ inch, exhaust pipe ¾ inch. How will these proportions answer? A. These proportions seem to be ample.

(38) H. C. S. asks: 1. What is the difference between ferrocyanide of potassium and the yellow prussiate of potash? A. They are the same. 2. What is the difference between bichromate of potash and red prussiate of potash? A. Potassium bichromate ($K_2Cr_2O_7$) is a potassium salt of chromic acid (H_2CrO_4). The red prussiate (potassium ferricyanide—$K_6(FeCy_6)_2$—is the potassium salt of hydroferricyanic acid.

Can you give me a recipe for artificial honey? A. You may try the following: Glucose (grape or starch sugar), 1 lb.; cane sugar, 2 ozs.; water, q. s. To this add a sufficient quantity of potato or corn starch boiled with water to a jelly, and about an ounce of gum arabic. Small amounts of molasses and flour are sometimes added.

What is used for strengthening essence of orange? A. As we understand you, tartaric acid.

(39) A. S., Jr., asks: What per cent of glycerin will prevent the congelation of water at 0° Fah., at —24° and at —32°, respectively, under ordinary conditions? A. An aqueous solution containing 10 per cent of glycerin, specific gravity 1·024, freezes at 30·2° Fah.; with 50 per cent of glycerin, specific gravity 1·127, freezes at —24·2° Fah.; with 60 per cent, freezes below —31° Fah.

(40) I. F. B. asks for the best way of freeing gas from aqua ammonia while passing through lime drier after leaving the retort. A. If you refer to coal gas, the ammoniacal vapors are not removed in the lime purifier, but in the hydraulic main, the condenser, and washer. See SCIENTIFIC AMERICAN SUPPLEMENT No. 140.

(41) W. T. P. asks why a cannon ball when shot up perpendicular from the earth does not have the same velocity or force in coming down as in going up? A. Because the force of gravitation which causes the ball to descend is less than the force of the gunpowder which sent it up.

(42) F. J. F.—For information on canning see article on p. 122, current volume, SCIENTIFIC AMERICAN.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

Judham, Ontario.—No. 1 is chalcopyrite. No. 2 is amethystine quartz. No. 3, dark muscovite. No. 4, apatite in quartz. No. 4, ferropyrite. The rock is probably auriferous. No. 6, pink orthoclase. No. 7, fluorite. No. 8, garnets in dolerite. No. 9, hematite and orthoclase. No. 10, rich magnetite. No. 11, cyanite.—W. G. S.—Quartz with iron sulphide—probably contains a trace of gold.—A. F. J.—It is a quartz pebble—sample returned.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

The Telephone. By J. H. R.
The Phonograph. By H. L., Jr.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Many of our correspondents make inquiries which cannot properly be answered in these columns. Such inquiries, if signed by initials only, are liable to be cast into the waste basket.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

August 27, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Anchorfluke supporter and tripper, E. Robbins.. 207,445
Animal trap, F. Egge..... 207,406
Animal trap, J. H. King..... 207,528
Axles, sand band for vehicle, A. Keiser..... 207,424
Bag holder, J. L. Friedriech..... 207,412
Bale tie, J. Y. Bloomingdale..... 207,486
Barb winder, B. F. Sellers..... 207,449
Barrel cover, Hartley & Little..... 207,517
Barrel head machine, C. Stout..... 207,455
Barrel trussing machine, H. R. Tyson..... 207,461
Barrels, drip basin for, E. F. Pfienger..... 207,439
Bed bottom, spring, J. N. Valley..... 207,462
Bed canopy, R. Shepherd..... 207,356
Belting, machine, J. Small..... 207,452
Bench attachment, work, J. M. Combs..... 207,504
Bobbin holder, G. H. Dimond..... 207,400
Boot and shoe heel, J. K. Tillotson..... 207,370
Bootee, C. McKiernan..... 207,431
Boots, etc., rotary cutter for, S. N. Corthell..... 207,395
Bottle, G. W. Clark..... 207,502
Brake, automatic car, W. L. Card..... 207,501
Brick machine, C. Chambers, Jr..... 207,343
Bridle and halter, R. E. Whitman..... 207,467
Broom, W. Walter..... 207,464
Broom handle, P. Lamboy..... 207,427
Buckle, harness, V. M. Beamer..... 207,478
Burial safe, A. Van Bibber..... 207,570
Burring cylinder, F. G. & A. C. Sargent..... 207,447
Butter package, D. C. Hill..... 207,417
Butteris, blacksmith's, H. B. Crandall..... 207,348
Caddy, E. Norton..... 207,541
Calculator, J. I. Bogue..... 207,487
Can for oils, etc., F. Westerbeck..... 207,578
Can, measuring, S. H. Humphreys..... 207,523
Car bumper, C. C. Neimeister..... 207,435
Car coupling, Bradbury & Barstow..... 207,341
Car coupling draw bar, E. H. Janney..... 207,525
Car roof, C. H. Thompson..... 207,569
Carpenter's gauge tool, E. R. & G. W. Dunlap..... 207,494
Carriage curtain fastener, G. R. Pierpont..... 207,546
Carriage jack, E. Prescott..... 207,442
Carriage jump seat, C. K. Mellinger..... 207,539
Cartridge, E. M. Wright..... 207,582
Chain links, bending, J. F. Busey..... 207,388
Chair, dental operating, J. O. Whitcomb (r)..... 8,389
Chair, folding, D. S. White..... 207,466
Chair, rocking, H. Lamprecht, Jr..... 207,359
Chair, rocking, S. Willershausen..... 207,580
Chill mould, S. Rogers..... 207,552
Churn, B. I. Williams..... 207,581
Churn dasher, O. P. Ahlgren..... 207,379
Clevis bolt, H. M. Willis..... 207,375
Coffee cleaning, etc., machine, H. Bamberger..... 207,383
Colter, S. Hathaway..... 207,352
Cooker, steam, R. N. Foote..... 207,410
Corset exhibitor, S. B. Ferris..... 207,351
Cultivator, sulky, F. W. Degen..... 207,398
Current wheel, T. J. Bottoms..... 207,488
Curtain fixture, S. Hedges..... 207,520
Detecter, waste water, W. E. Worthen..... 207,378
Dish, covered, W. C. Homan..... 207,522
Ditching machine, J. H. Wilson..... 207,376
Drain trap, J. H. Blessing..... 207,482
Dredger for salt, etc., L. Morgan..... 207,434
Drill, grain, T. C. Clark..... 207,503
Drills, colter for grain, J. T. West..... 207,577
Egg opener, G. W. H. Krey..... 207,426
Embalming, tubular needle for, S. Rodgers..... 207,551
Engine, etc., electro-magnetic fire, L. G. Woolley 207,377
Engine, hydraulic, Chandler & Silver..... 207,391
Engine, road, W. L. Hussey..... 207,524
Engine, wind, I. H. Palmer..... 207,545
Feed cutter, L. Becker..... 207,479
Feed water heater and filter, W. J. Austin..... 207,337
Fence, P. Hayden..... 207,518
Fence, K. McKinnon..... 207,537
Fence, J. B. Robertson..... 207,550
Fender, J. S. Lester..... 207,362
File, bill and paper, H. Baldwin..... 207,477
Filter, liquid, C. T. Haas..... 207,515
Fire alarm, electrical, J. O. Fowler, Jr..... 207,510
Fire arm, magazine, G. F. Evans..... 207,350
Fire escape, D. F. Hunt..... 207,419
Flour bolting machine, A. W. Schoenleben..... 207,448
Fork, manure, B. F. Barr..... 207,338
Fruit box, G. O. Cole..... 207,347
Fruit box, J. J. Philbrick..... 207,440
Game counter, J. H. Dasey..... 207,396
Gas exhaust regulator, R. K. Huntoon..... 207,421
Gas generator, J. W. Hodges..... 207,521
Gas, illuminating, D. W. Hunt..... 207,420
Gas, manufacturing water, W. A. Goodyear..... 207,413
Gas tubing, flexible, W. Bourguignon..... 207,489
Gearing, W. J. McDougall..... 207,430
Glazed ware, ornamenting, W. F. Niedringhaus.. 207,543
Gong pull, pneumatic, H. V. Aiken..... 207,380
Grain separator, A. J. Hartwell..... 207,416
Grain separator, F. W. Young..... 207,583
Grating, T. F. Baker..... 207,476
Griddle, cake, J. V. Taylor..... 207,459
Hame, P. Hayden..... 207,519
Hammer, steam, T. R. Morgan..... 207,542
Harvester, D. Sager..... 207,554
Hat, folding, J. A. Harrington..... 207,353
Hatchway, J. M. Van Osdel..... 207,571, 207,572, 207,573
Heater, fire place air, L. Johnston..... 207,526
Heating buildings, J. Johnson..... 207,422
Heel scouring machine, S. N. Corthell..... 207,394
Hinge for sleeping berths, Carlton & Crager..... 207,390
Hoeing machine, H. N. Prout..... 207,443
Hog catching device, R., Sr., & R. Pemble, Jr.... 207,437
Hog cholera compound, E. Anderson..... 207,474
Hog cholera compound, W. Cline, Jr..... 207,345
Hog picking machine, H. G. Locke..... 207,534
Horse checking device, J. Davies..... 207,397
Horse detacher, J. H. Voss..... 207,574
Horse power, E. Golucke..... 207,512
Horses, toe weight for, A. F. Pitt..... 207,547
Horseshoe nails, forging, S. S. Putnam..... 207,444
Hose clamp, F. W. Wolf..... 207,469
Hose coupling, F. W. Wolf..... 207,470
Jointflanges, forming, F. P. Cady..... 207,342
Jointer clamp, M. D. Slocum..... 207,451
Knife cleaning apparatus, L. Guex..... 207,514
Lamp, C. H. Scholle..... 207,369
Lamp, J. J. Thomas..... 207,400
Lamp burner, W. R. Underhill..... 207,372
Lamp burner, W. N. Weeden..... 207,576
Lamp, street, W. R. Underhill..... 207,371
Lamp, vapor burning, J. S. Wood..... 207,471
Lantern, C. T. Ham..... 207,516
Lead, manufacture of white, J. C. Martin..... 207,364
Leather stretching machine, H. N. Dodge..... 207,508
Lock, permutation, A. Heilbrun..... 207,354
Lubricator, P. Hoffman..... 207,355
Lubricator, vehicle axle, W. J Drew..... 207,493
Lubricator, vehicle axle, L. Llewellyn..... 207,361
Malt plow, C. Fey..... 207,495
Mechanical movement, J. H. Kersey..... 207,425
Medical compound, J. Powers..... 207,368
Medicine case, J. C. Litzelle..... 207,360
Millstone driver, J. W. Donnel..... 207,401
Mirror attachment, G. H. Wilcox..... 207,579
Motor, J. F. Driver *et al.*..... 207,403
Nut lock, E. Bourne..... 207,386
Oil cloth, manufacturer of, A. F. Buchanan..... 207,491
Organ, reed, J. R. & S. R. Perry..... 207,438
Ozone, producing, J. Buchanan..... 207,496
Padlock, F. Egge..... 207,407
Paper cutter and winder, I. Frank..... 207,411
Paper pulp from wood, making, J. Taylor..... 207,568
Paper pulp, treating wood, G. E. Marshall..... 207,428
Paper stock, separating fibers of, P. & G. C. Rose 207,553
Peanut roaster, G. B. Hall..... 207,414
Pen, fountain, Dieckman & Burgau..... 207,399
Pencil sharpener, H. G. Downs..... 207,402
Photographic printing frame, W. H. Laird..... 207,358
Picture frame, A. Komp..... 207,532
Picture frame clamp, E. N. Porter..... 207,441
Planter, seed, W. T. Easterday..... 207,404
Plow beam, Bump & Gear..... 207,497
Plow, side hill, Wilson & McCanles..... 207,468
Plow stock, adjustable, J. K. Kirksey..... 207,530
Pump, cattle, E. Taylor..... 207,458
Pump, double-acting, J. A. Sinclair..... 207,561
Pump, lift, W. Loudon..... 207,536
Pump regulating valve, J. H. Blessing..... 207,483, 207,485
Printing machine, block, A. F. Buchanan..... 207,490
Printing press, J. Burrell..... 207,499
Radiator valve, W. H. Meredith..... 207,540
Railway car signal, electric, Mees & Sherman..... 207,538
Rake, horse hay, W. P. & C. E. Clark..... 207,392
Refrigerator, W. Horn, Jr. *et al.*..... 207,356
Refrigerators, ice grate for, J. M. Ayer..... 207,382
Rock channeling machine, A. G. Webster..... 207,374
Rolling hoes, picks, etc., machine for, J. Pedder. 207,367
Rowlock, J. Weyman..... 207,465
Saw, circular, G. F. & D. Simonds & Marshall..... 207,450
Saw gummer, H. C. Strong..... 207,456
Scissors sharpener, W. H. Barwick..... 207,339
Screw cutting die stock, T. H. Rose..... 207,446
Scythe fastening, A. W. Flanders..... 207,409
Seal, metallic, J. Sweeney..... 207,567
Sewing machine, A. Steward..... 207,454
Sewing machine, boot and shoe, L. R. Blake..... 207,340
Sheave or pulley, H. Loud..... 207,535
Sifter, coal and ash, T. F. King..... 207,529
Sign, E. Powell..... 207,549
Sink, set back, C. Copman..... 207,393
Sled, W. Chegwin..... 207,344
Spring support, vehicle, J. C. Leathers..... 207,533
Spring, vehicle, B. F. Fuller..... 207,511
Spring, vehicle, G. Judd..... 207,423
Sprinkler, external window, etc., J. Bennison..... 207,385
Steam or gas, nozzle for, G. Beck..... 207,384
Steam trap, J. H. Blessing..... 207,484
Stench or basin trap valve, W. E. Worth..... 207,472
Stench trap, B. J. Downey..... 207,492
Stovepipe drum, G. H. Simon..... 207,560
Stringed instruments, peg for, A. Stuttaford..... 207,566
Stump extracting machine, A. M. Michael..... 207,541
Stump extractor, A. J. Alley..... 207,381
Suspenders, H. Knopf..... 207,531
Switch chair, J. C. Eggleston..... 207,408
Table, tailor's, A. Warth..... 207,575
Tackle block, J. L. Pope..... 207,548
Target thrower, ball, A. A. Call..... 207,389
Telegraph, fire, etc., J. O. Fowler, Jr..... 207,509
Telephone, mechanical, S. S. Parsons *et al.*..... 207,436
Thill and harness, combined, R. B. Boynton..... 207,387
Thill coupling, J. T. Hards..... 207,415
Thill coupling, A. E. Mook..... 207,433
Thimble skein, A. M. Disbrow..... 207,507
Thrasher and separator, grain, A. J. Hoag..... 207,418
Tobacco cutter, A. S. Bunker..... 207,498
Tool, combined, P. Campbell..... 207,500
Torpedoes, raising and lowering, W. D. Smith..... 207,564
Toy, W. S. Clow..... 207,346
Toy, Ibandelore, W. Katz..... 207,527
Trace carrier, Goodrich & Parker..... 207,513
Track clearer, A. Day (r)..... 8,388
Truck, car, J. Belou..... 207,480
Truck, car, G. Souther..... 207,453
Truck, hand, W. B. Allen..... 207,473
Turning tool, metal, H. Smith..... 207,562
Type writing machine, C. L. Sholes..207,557, 207,558, 207,559
Types, dresser for printing, T. Mason..... 207,429
Umbrella, A. G. Kuball..... 207,357
Valve, air, J. H. Blessing..... 207,481
Valve for barrels, etc., self-closing J. A. Moffitt.. 207,432
Valve, oscillating steam, C. J. Van Depoele..... 207,463
Valve, stop, J. O. Morse..... 207,365
Ventilator, A. Unger..... 207,373
Vessels, construction of, B. F. Delano..... 207,505
Vise, T. E. Dutton..... 207,349
Wagon jack, R. W. Marshall..... 207,363
Waistband, L. T. Smith..... 207,563
Waiter, S. W. Babbitt..... 207,475
Washing machine, M. L. Scivalley..... 207,555
Washing machine, T. Stumm..... 207,457
Washing machine, pounder, T. Snow..... 207,565
Weather strip for door sills, G. B. Norton..... 207,366
Wells, driller and pumper for, A. & A. I. Dingley 207,506
Wells, rock drill for, J. F. Summers (r)..... 8,390
Wire barbing instrument, L. Eberhart..... 207,405

[For the week ending August 20th.]

TRADE MARKS.

Accordions and other reed, pipe, and flute instruments, The National Musical Instrument Manufacturing Company..... 6,497
Chemicals, Anthony Pirz..... 6,485
Cigars, etc., Levy Brothers..... 6,503
Cigars, California Cigar Box Company..... 6,490
Cigars, etc., Kerbs & Spiess..... 6,493
Cigars, etc., Edward Hilson..... 6,500
Cologne, J. A. Lansing..... 6,502
Cologne water, J. M. Farina..... 6,482
Graphite for stove polish, etc., The Joseph Dixon Crucible Company..... 6,486
Marble, Pleasantville Land Company..... 6,507
Marking ink, Blackwood & Co..... 6,498
Medicinal preparation, J. C. Kerr..... 6,494
Medicinal preparation, Mrs. Joe Person..... 6,495
Medicinal preparation, The Franklin Company..... 6,496
Mustard, Burns & Byram..... 6,499
Paper collars and cuffs, H. A. Mann, Jr..... 6,506
Plastic composition, The Bonsilate Company..... 6,509
Printed publications, Keppler & Schwarzmann..... 6,501
Salt, Richard Evans..... 6,492
Shovels and scoops, E. H. Linley..... 6,484
Smoking tobacco, etc., American News Co.....6,489, 6,508
Smoking tobacco, B. Leidersdorf & Co.....6,504, 6,505
Smoked, etc., beef, pork, etc., C. J. Comstock..... 6,487
Soap, Day & Frick..... 6,491
Stove polish, J. C. Jacoby & Co..... 6,488
Woven cotton and woolen fabrics, H. Fogg & Co... 6,483

DESIGNS.

Counterpane or quilt, William O'Hanlon..... 10,786
Funeral ornaments, C. E. McFarlan..... 10,784
Toilet cover, counterpane, etc., John Crossley..... 0,785
Umbrella handle, Amasa Lyon..... 10,783

NEW PATENT LAW
FOR
Spain, Cuba, Porto Rico, etc.

By the terms of the New Patent Law of *Spain*, which has lately gone into operation, the citizens of the United States may obtain Spanish Patents on very favorable conditions.

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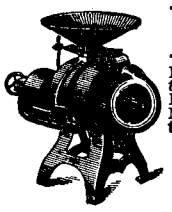

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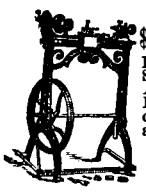

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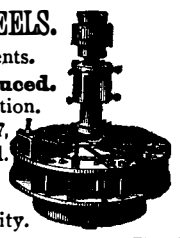

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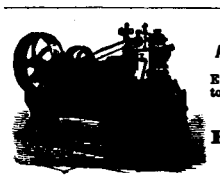

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